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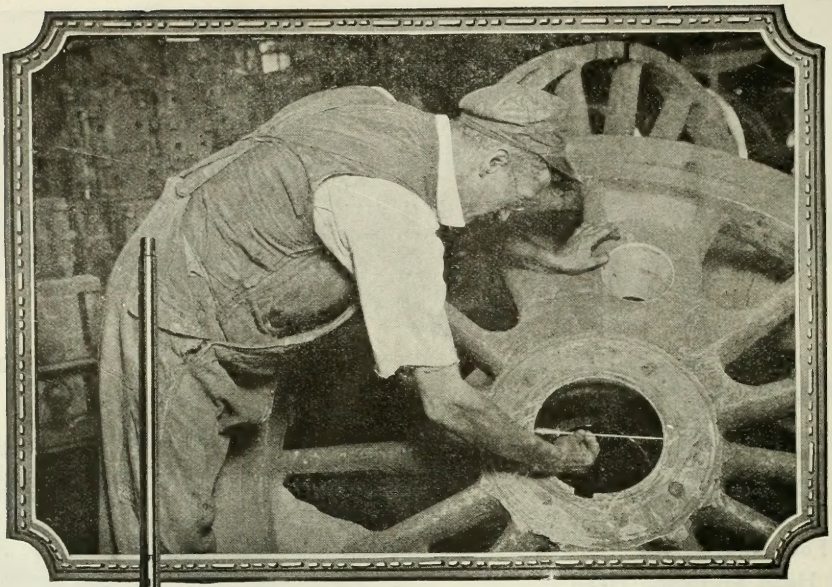

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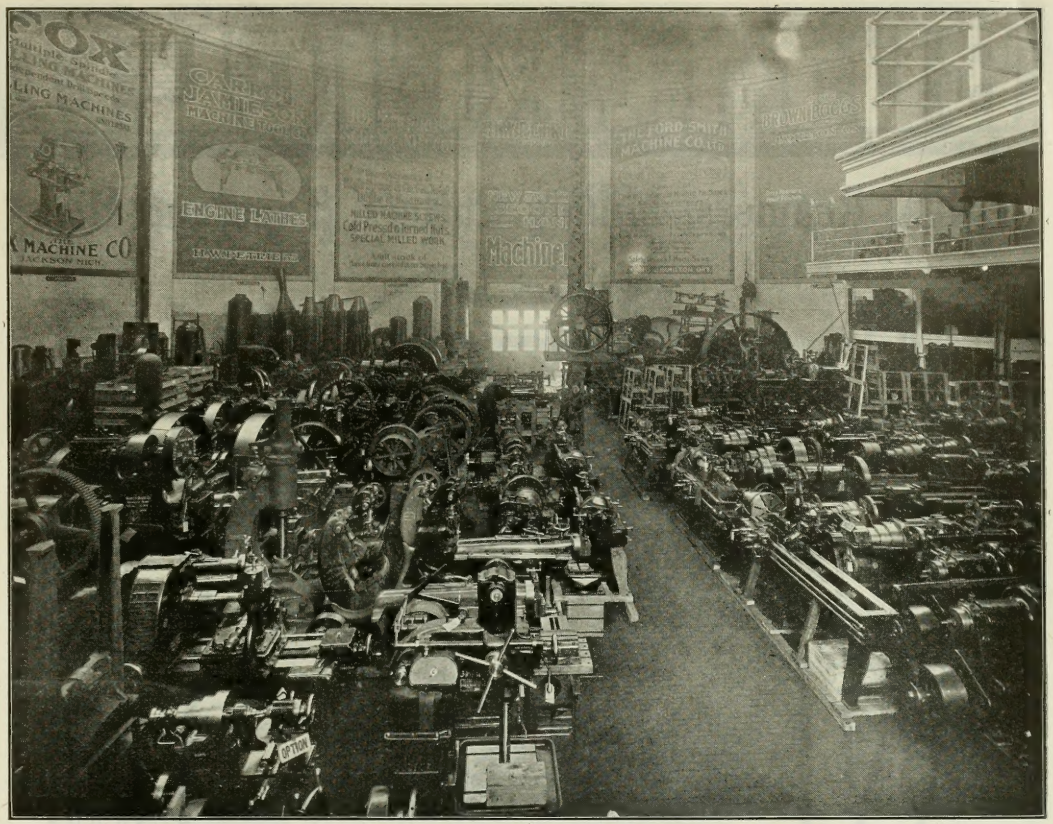

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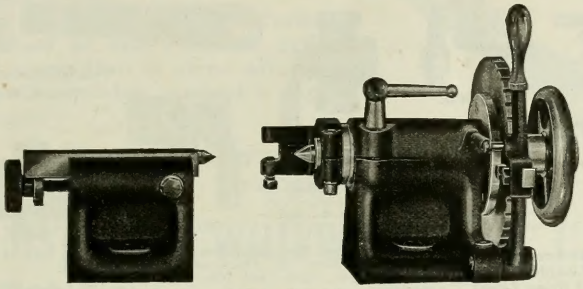

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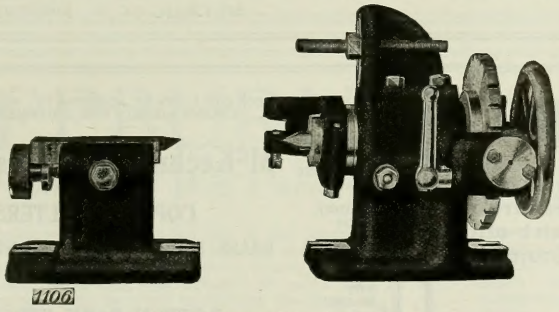

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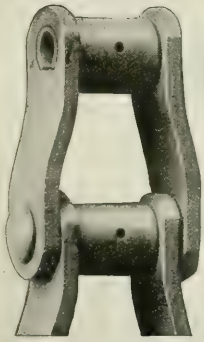

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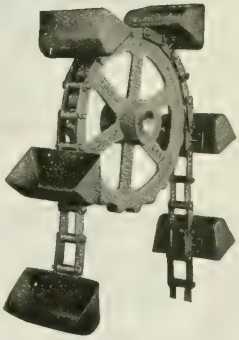

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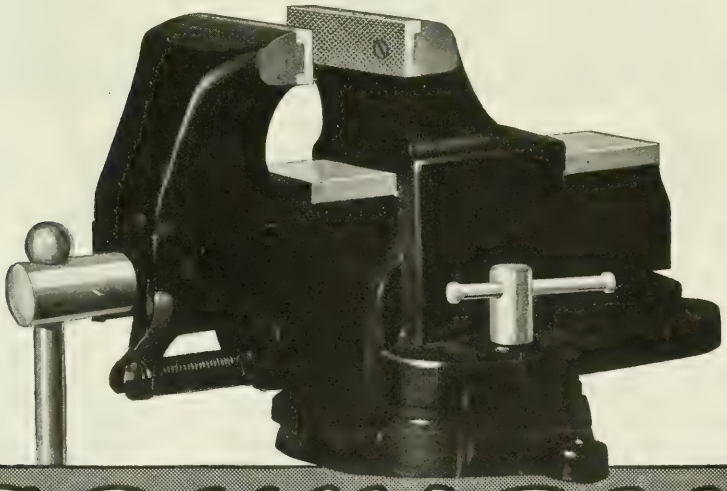

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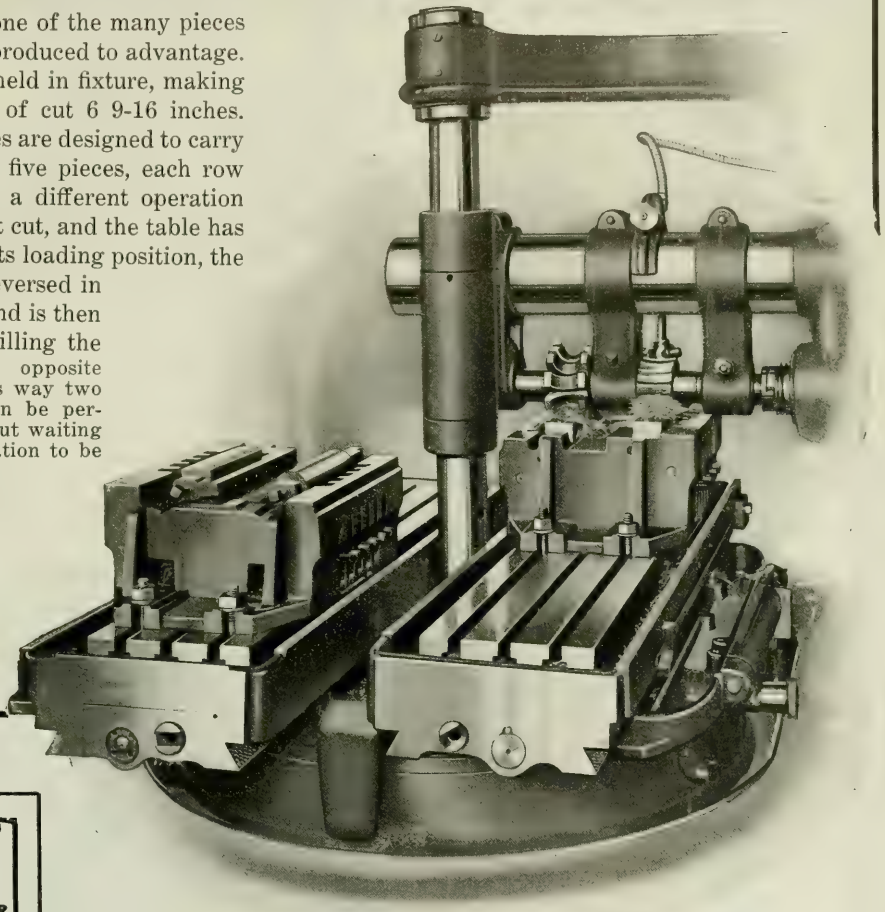

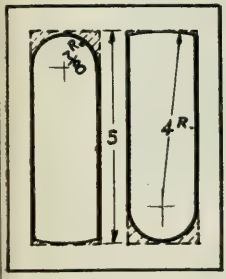

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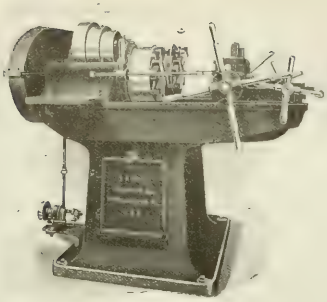

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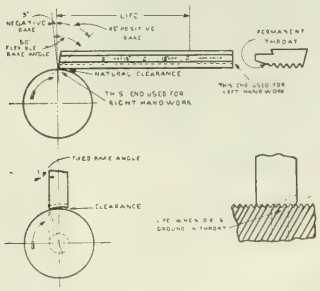

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CANADIAN MACHINERY
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VOL. XXV. No. 12 March 24, 1921

Tooling the Modern Turret Lathe

Machining magneto cam case—Use of special jaws — holding concentricity of work — Machining gun-metal bush—Automatic threading tool—Machining flywheel for motorcycle.

By A. H. Lloyd B. Sc., M.B.E.

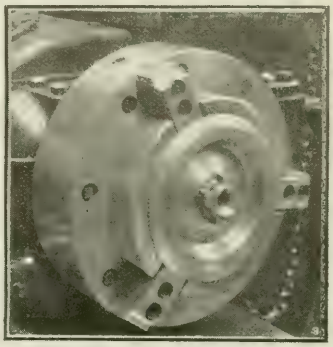


FIG. 11—CHUCKING MOTOR CYCLE FLYWHEEL

HAVING dealt with chucking and fixtures in a previous article in Feb. 17th issue of Canadian Machinery, let us next consider some interesting examples of tooling.

The first example shown at Fig. 1 illustrates the method of machining a magneto cam case on a Herbert No. 4 capstan lathe. This piece is made from a brass stamping from which there is a comparatively small amount of metal to be removed, but the tolerances, as is usual in magneto work, are very fine.

Fig. 12 illustrates the first operation. On looking at the piece in the chuck you will see that there is an interesting set of special chuck jaws which are shown in greater detail in the lay-out at Fig. 13. The tools are numbered on this lay-out in the order in which they are applied to the work, and at the top you have a front view of the special jaws. These are made with a short shoulder, so that they square up the flange and provide a definite end location.

Tool No. 1 is a facing tool for the end, which is used in the square turret. No. 2 is a flat drill. No. 3 is a standard knee-turning tool carrying a cutter for turning the outside diameter, and a special boring bar carrying a flat cutter for rough boring and facing the bottom of the large bore. No. 4 is similar and finishes the surfaces corresponding to those machined by No. 3. There is, however, an additional cutter for cutting the groove at the bottom of the large hole. No. 5 is a single point boring bar for sizing the bore, whilst No. 6 is a boring bar carrying a cutter head which finishes the small bore, forms the radius at the mouth of the small bore, and forms the external radius on the end of the casting. It will be noted that tools 3, 4, 5 and 6 are all piloted in the chuck steady bush. It is good practice to make these steady bushes taper on the outside and fit them into a liner with a taper bore which is left in the chuck. This taper is approximately the same included angle as a Morse taper, and facilitates

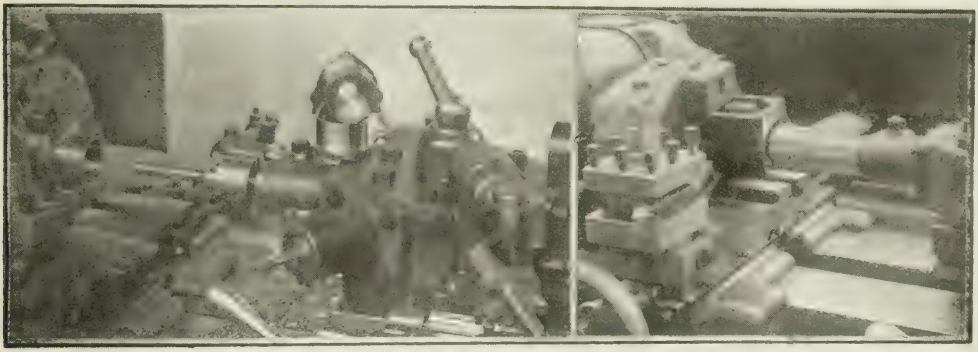


FIG. 1—FIRST OPERATION ON MAGNETO CAM CASE.

FIG. 4 BORING YOKES FOR LIGHTING DYNAMOS.

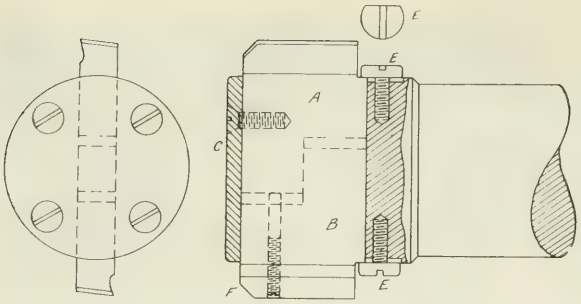


FIG. 5—DETAIL OF FLOATING CUTTER BAR.

removing the steady bushes from the chuck.

Second Operation

In the second operation shown at Fig. 3 the method of chucking deserves some attention, as it illustrates how the concentricity of the work accomplished at the second operation is obtained in relation to the first operation. The steady bush in this case is made a sliding fit in the large bore finished at the first operation and on this the work locates. Gripping and driving are done by the soft jaws, which are bored out true, but it is important to note that concentricity is not dependent upon the truth of the soft jaws, but upon the locating plug. Tool No. 1 in the square turret faces the flange and the end, 1A being used for the finishing operation on the same surfaces. No. 2 is a standard knee-turning tool carrying a rough turning cutter and a piloted four-flute reamer for rough boring and bottoming. No. 3 is a similar combination to No. 2, but takes a second cut. No. 4 is a boring bar carrying an undercutting tool, which produces the groove at the bottom of the bore. No. 5 is a sizing boring tool. No. 6 is a knee-turning tool for sizing the spigot, and uses one of the first operation boring bars as a pilot, but without cutters. No. 7 is a boring bar for forming the radius in the small bore, and carries cutters for forming the internal and external radii.

The next photograph, Fig. 4, shows the lay-out for boring a yoke for motor car lighting dynamos. Whilst it is quite an ordinary tool lay-out it has one point of interest in showing a method of sizing holes, which is, to my mind, rapidly replacing adjustable reamers. In sizing holes 1 in. and upwards our firm recommend the use of boring bars with adjustable floating cutters, which produce a very smooth and accurate hole with a minimum of trouble. In the illustration shown the floating cutter bar is in position in front of the work, and at Fig. 5 is given the details of construction.

The cutter is made in two parts, "A" and "B," which are a sliding fit in a slot across the end of the bar. In this slot the cutter is retained by the front plate "C," and the amount of transverse movement or "float" is limited by the screws "E," which overlap the slot. The flat on the head of the screws allows the cutters to be withdrawn when either of them is partly turned. The two parts of the cutter are separated by the screwed pin "F," which also provides the diameter adjustment. When screwed in the diameter produced by the cutters is increased and vice versa. Each size of bar will take several sizes of cutter, and each cutter may be adjusted from 1-16 in. above to 1-16 in. below nominal size. The previous boring bar should preferably be of the single point type and should leave about 0.005 in. to 0.007 in. for the sizing bar to remove. These tools have been standardized for holes from 1 in. to 5 in., and have been made for bores as large as 10 in., with satisfactory results.

Machining Gunmetal Bush

Next example, Fig. 6, shows the lay-out for machining a gunmetal bush, a detail of which is given in the right-hand corner. This is a very good example of a capstan lathe lay-out, which is tooled up with a view to eliminating all unproductive operations. The tolerances are not particularly fine, .0015 in. up and down being allowed on the bores, the same on the threads and the small diameter. The large external diameter is not important. Chucking is done in a Coventry chuck by gripping with special jaws on the hexagon head, and whilst the jaws are being tightened the tapered plug 1 is brought into position and centres the core. No. 2 is a standard knee-turning tool, carrying a special turning holder with two cutters for dealing with the two external diameters simultaneously, and a boring bar with three boring cutters and one chamfering cutter. The design of this rough boring bar embodies one feature which is well worth noticing. It will be realized that with two turning cutters and three boring cutters operating on the casting simultaneously, there is a very strong tendency for the work to move in the chuck jaws in view of the overhang and the consequent leverage. The first cutter to reach the work is the second boring cutter from the front, which starts to bore and traverses about 3-8 in. before any of the other cutters come on. The diameter behind the second cutter is made a few thousandths less than the size of the rough bore, so that when the bar enters the bore it acts as a steady as the turning cutters and remaining boring cutters come on. By this means a coarse feed can be used without any danger of the work moving in the chuck.

No. 3 is a similar tool for the finishing operations, but in this case the boring bar does not fit the hole. No. 4 is a revolving steady peg, which is

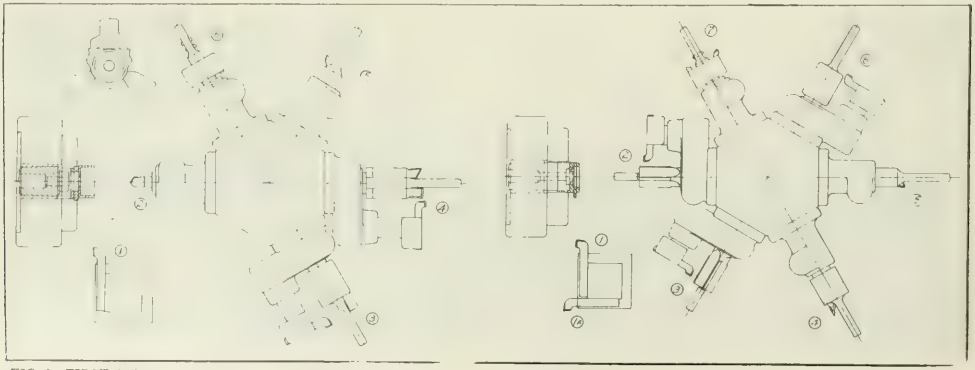


FIG. 2—FIRST OPERATION LAYOUT ON MAGNETO CAM CASE.

FIG. 3—SECOND OPERATION ON THE MAGNETO CAM CASE.

brought into the work when applying the form tool holder 5, carried on the back of the cross slide. The form tool holder carries a chamfering cutter, chamfering and facing tool, a grooving cutter, and a chamfering and facing tool for the end. Tool No. 6 provides the means for cutting the external threads, and is the "Coventry" patent automatic threading tool. In this there are six chasers, the threads of which are in pitch with each other, but each chaser cuts a thread a little deeper than the one which precedes it, the last chaser forming the full thread. The cross slide is set in to a stop, and the chasing mechanism engaged. The chasers then come successively on to the work until the first chaser has reached the groove.

By this time the bar at the rear of the tool holder has come in contact with an adjustable stop on the bed, for arresting the bar which now slides through the holder. This bar is stepped and successively the chasers pass over the step and are withdrawn from the work. It will be noted that the first chaser has actually tripped. During the chasing operation the work is still supported by the revolving steady. The actual time for cutting the external thread, which is done at one traverse, is 4 seconds. Tool No. 7 is an eccentric recessing tool for cutting the groove at the back of the internal thread. This type of tool is better for this particular job than the ordinary recessing tool slide, since it is tied up to the work by a revolving bush running on the tool itself. No. 8 is a "Coventry" collapsing tap which cuts the internal thread in three seconds. The machining time for the complete lathe operation is two minutes.

Fig. 7 illustrates the machine set up on the operation just described and gives a good view of the automatic threading tool, the collapsing tap, the form tool holder, and the knee-turning tools. A detail of the construction of the automatic threading tool is given at Fig. 8, which is a plan view with the cover removed. The stepped bar which retains

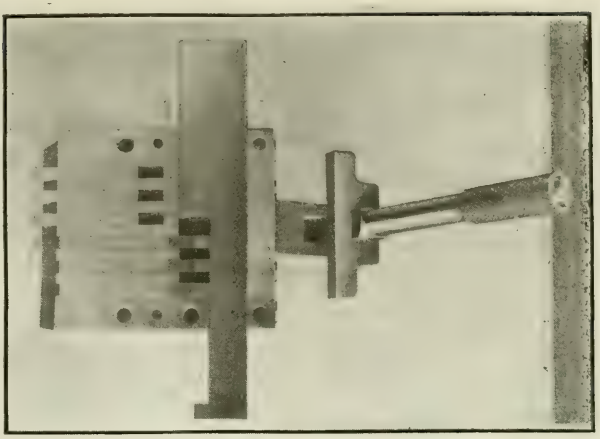


FIG. 8 DETAIL OF THE AUTOMATIC THREADING TOOL.

the chasers is clearly seen in the cutting position; three of the chasers have been withdrawn and the fourth is about to trip. Withdrawing is effected by spring detents, one of which lies above each chaser. They project through the rear of the tool holder, and a pivoted lever is provided to push them into the cutting position before commencing the next piece of work. Spring return is provided for the stepped former bar, so that when the chasers are pushed forward into the cutting position the former bar shoots from right to left.

Machining Flywheel

Coming to some larger work we will next consider a lay-out of tools for machining the motorcycle flywheel shown at Fig. 9. This is a component of the Scott motorcycle and is made from a mild steel drop forging. The outside diameter is 9 in., and the overall length about 2 3-16 in. It requires to be machined over all, except for a fluted portion on the boss, which is, of course, inaccessible as a lathe operation. The boss is counterbored from either side and tapered, the tapers meeting in the middle. There is also a small spigot on the boss, which requires to be accurately sized. Generally speaking, the machining on the two sides of the flywheel is identical, except that in one case the dished web is concave, and in the other convex. It is, however, important that the machining on both sides should be concentric and one of the inspection tests is to mount the flywheel on its cranks, which fit in the two taper portions, and run the whole arrangement between centres. The outside and the sides of the flywheel must then run true within very close limits.

Fig. 9 illustrates the first operation, in which the stamping is chucked by gripping under the rim. This method of chucking has the advantage that the outside diameter can be machined right across without the necessity of matching up. In the choice of a chuck for turret lathes it is important to choose

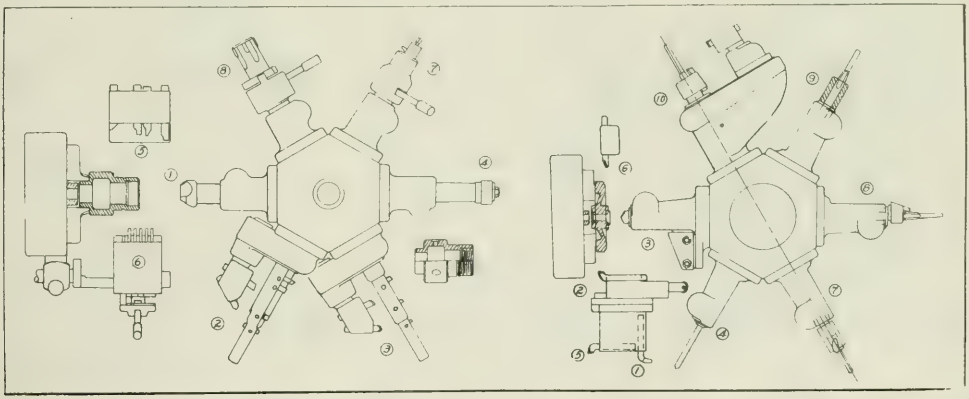


FIG. 6—LAYOUT OF TOOLS FOR MACHINING GUN-METAL DISTRIBUTOR BUSH.

FIG. 10—LAYOUT OF TOOLS ON FIRST OPERATION OF MOTOR CYCLE FLYWHEEL.

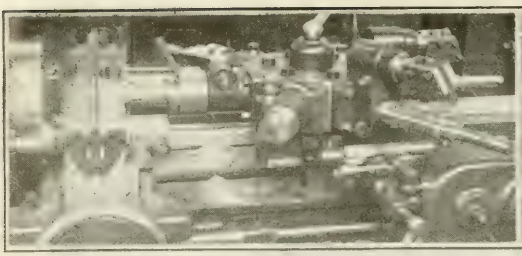


FIG. 7—SET UP FOR MACHINING GUN—METAL DISTRIBUTOR BUSH.

FIG. 9 FIRST OPERATION ON THE SCOTT MOTOR CYCLE FLYWHEEL

one which is equally powerful in gripping outward or inward.

The lay-out for the machining of this piece is shown at Fig. 10. No. 1 is a tool for rough facing the side, rough turning the exterior and boss. No. 2 illustrates the method of machining a bevelled face with a single point traversing cut. This is a case where it would be bad practice to bring a broad form tool on to the scale, and the method of profiling used in this case is one which is recommended for either straight or curved bevelled faces. The cutting tool is carried in a slide which can move parallel with the axis of the lathe, this slide being fixed in the square turret. At the right-hand end is a copy roller, which, when engaged with the cam on tool holder No. 3, causes the cutting tool to move in a patch governed by the former when the transverse feed is set into motion. In the slide there is a spring which acts in the same direction as the pressure of the cut and keeps the roller in contact with the former. No. 3 is a flat centering tool for starting the drill.

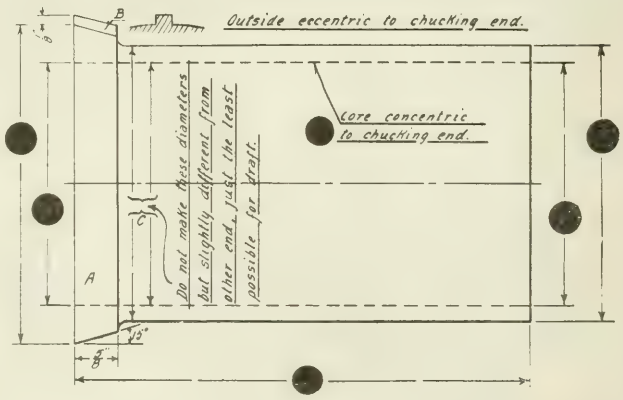
The boring bar holder in this case is special, as it is arranged to carry the former for profiling, since there is no vacant turret face. No. 4 is a twist drill; No. 5 a finish turning and facing tool for the side, the exterior and the spigot; No. 6 a chamfer form tool carried in the back tool post; No. 7 a counterboring tool for the recess in the boss. The depth of this has to be very accurate, and is therefore determined by a stop collar mounted on the tool itself, which comes up against the boss. In a case such as this it is a more accurate method of working than from the turret slide stops. No. 8 is a roughing taper reamer on which is mounted a cutter for forming the radius in the mouth of the counterbore. No. 9 is a finishing taper reamer which is also provided with a stop collar to ensure accurate plug depth. No. 10 is an adjustable knee-turning tool piloted and carrying sizing cutters for the spigot and the exterior. The object of sizing the exterior is to provide a convenient location for the second operation. While on the subject of turning to size it is important to note that when this is done from the turret it is good practice to have the cutter vertically over the work, so that any slight inaccuracy in the indexing of the turret does not materially affect the size produced.

The machining at the second operation is practically identical with the first, and the interest lies in the method of chucking, this being shown at Fig. 11. This special method of chucking is adopted to obtain the concentricity which has already been mentioned. Bolted to the chuck face is a special faceplate; this is hardened and the bore ground out perfectly true. At the first operation the outside diameter of the flywheel is made so that it is a nice sliding fit in the faceplate. The gripping and driving is done by soft jaws, which are admitted by three slots cut in the faceplate, but these jaws have no influence on the centering of the work, which is done entirely by the faceplate. Flywheels machined by this method face the concentricity test satisfactorily, and the production time is in the neighborhood of an hour apiece. In a later article we will consider some further lay-outs.

Will Need Equipment.—T. & N. O. shops at North Bay have completed plans for the remodelling of their machine shop and will be installing some new equipment.

Cutting Piston Rings

Having a large number of rings to make for pistons it was found advisable to cut these from what is known as a pot casting. This casting is shown in the accompanying drawing. The casting was turned and bored and it was then cut up into narrow rings, but perhaps the most interesting feature of the operation was the fine attention to the details of manufacture which the drawing indicates. At the end A, a piece for gripping in the chuck had been cast on, this is bevelled and when gripped in the chuck corresponds with the beveled jaws, thus the part is more securely held than would be possible if any special flange were provided. On this flange a lug B is cast, which comes against one of the chuck jaws to prevent a soft backing and prevent the pot casting from turning, should there be a tendency to slip. Another interesting note is indicated at C, and this calls attention to the fact that very little draft is required on the hole of the casting. When such notes as these are provided on the drawing, the error of omission is reduced to the minimum, and notes which are found to be advisable for manufacturing purposes are not left to the judgment of the workman in the shop. As a number of different sizes of these were required, the drawing was made with blank spaces at the dimension lines which had to be filled in to suit the particular size desired, thus doing away with the necessity of making separate drawings for each size.



By G. H.

Canadian Machinery.

CHARTS OF SIMILAR NATURE TO THIS WILL APPEAR EVERY WEEK.

Machine Tool Builders New Accounting Plan

Job Order Costs—Burden Distribution—Fixing the Burden Rate —Rate to Use—Separate Kinds of Business—Supplies, Small Tools, Repairs, and Depreciation

DURING the recent meeting of the Machine Tool Builders at Cleveland, Ohio, Mr. Scovell gave a report of an investigation by the Scovell-Wellington Co. This paper covered a very wide range, and although we cannot find space to print the material in its entirety, here are a few of the points brought out. As far back as December, 1920, this concern was instructed to hold a series of regional meetings. This was done in Chicago, Cincinnati, Cleveland, Worcester and New York, between Jan. 11 and Jan. 20, with the result that valuable information was secured, some of which follows. It is, of course, understood that we have picked out only the points that, in our estimation, will interest our readers.

Job Order Costs

There is no doubt that good cost accounting for the machine tool industry requires the operation of what is known as a job-order cost system, that is, a system which shall show the cost of the jobs which are issued to the shop—material, direct labor and a proper amount of overhead or burden. According to the information collected from the questionnaires, a large majority of the machine tool builders are already handling material and labor in a reasonably satisfactory way, so that any discussion of better or more uniform methods of accounting in the industry will be concerned almost entirely with the development, distribution and application of overhead or burden.

Burden Distribution

The chart, Fig. 1, shows in graphic form the approved plan of collecting costs, particularly in respect to burden. A study of the chart will show that the aim is to allocate to each department or operating center of the business all the charges which belong there, and which should therefore be absorbed in the normal work done in that department or operating center.

One feature of this burden distribution which may be new to some is the plan for adding a portion of the burden on to material as it goes into the work-in-process. This idea is indicated on the chart by the lines which run from rectangles 37 and 38 to rectangle 43, and a somewhat similar charge on the cost of finished stock, storage and shipping is indicated by the line running from rectangle 39 to Selling Expense, rectangle 56. It should be clearly understood that this is a burden charge on material used. There is no suggestion of increasing the value of the unused inventories. Furthermore, only one calculation is required for all the material used on the job during the month; so that although it is a desirable refinement in accounting, it adds nothing to amount to anything in the way of additional clerical work.

Interest on Investment

After a thorough consideration of the matter, the executive committee has decided unanimously to recommend to the industry that interest on investment be included in calculating the cost of manufacture. Without this accounting device the overhead or burden of different departments, or of different machine tools, will not be correctly stated, particularly that large and costly tools will otherwise have an insufficient burden rate, as there will be nothing to measure the cost of tying up capital in such equipment in comparison with light and relatively inexpensive machines. There is everything to gain and nothing to lose by carrying interest on investment as a factor in the fixed charges, rectangles 20 to 29 inclusive, and taking it up as a credit, under miscellaneous income, rectangle 54.

As to details of this practice, it should be explained that interest will be reckoned on all the assets employed in manufacture—land, buildings, equipment and inventories. The immediate effect is to increase the burden of that work which is done with large and costly machines in comparison with that work which is done with a smaller capital investment. As the product will include this element of cost, the stated value of the inventory of finished and partly finished work will be, to that extent, increased; but a reserve for the amount of interest included may, if desired, be deducted from the inventory assets in stating the balance sheet at the end of the year. There is some additional incentive to do this if there is an increase in the actual volume of such inventory during the year.

It should be further noted that only by charging interest on investment can the cost accounting in plants that are wholly or in part rented be made uniform with plants that are wholly owned. What is more important in this industry, it is only when interest on investment is reckoned on the assets that are utilized in the business that correct costs can be figured on patterns made in the company's pattern shop in comparison with patterns bought outside, or castings produced in the company's own foundry in comparison with castings purchased from others. Considerations like this are very important in a plan for uniform cost accounting.

A similar situation arises in respect to an auxiliary department like a power house. When members buy power, they necessarily get into their costs all such fixed charges on the capital used, and certainly no one would think of making a comparison between the cost of power purchased and the cost of power generated on the premises without reckoning into the latter the fixed charges of every kind on the capital required as well as the current operating expenses.

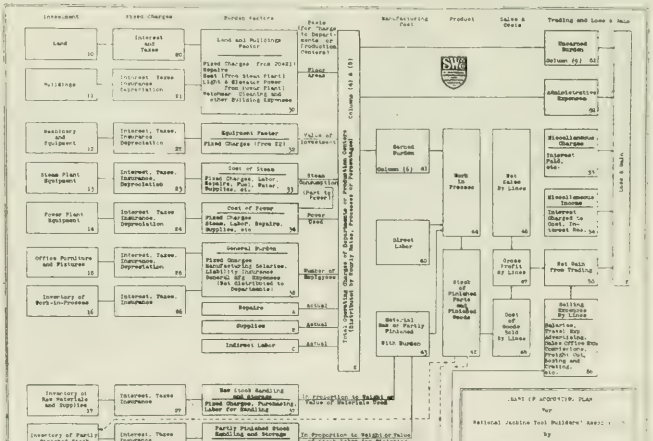


FIG. 1—CHART SHOWING ACCOUNTING PLAN.

Finally there is a marked disposition to reckon into costs interest on borrowed money, or interest on bonded debt; and whereas charges of this kind are incorrect in principle, and most objectionable in practice, they do reflect a sentiment which is well nigh universal in the business world that the use of capital is cost, which should be recognized before anything like a profit is calculated for the business.

Fixing Burden Rate—The Normal Rate

All of the overhead or burden of an operating department is represented by the long vertical bar, rectangle K, in the middle of the chart. This total, as the chart shows, is made up of (a) Land and Buildings Factor, rectangle 30, distributed to the several departments on the basis of the area occupied by each; (b) Equipment Factor, rectangle 32, apportioned according to the value of the equipment used in the several departments; (c) Steam and (d) Power costs, rectangles 33 and 34, distributed pro rata to the steam and power consumption; (e) General Burden, rectangle 35, distributed in proportion to the number of employees; and finally (f) Repairs, Supplies and Indirect Labor, rectangles A, B and C, charged to the several departments as actually incurred.

The idea of distributing or apportioning burden to "departments" or "production centers" is applicable particularly to the larger shops. For the small shop the idea is to develop or recognize all the burden that exists, and make plans to have it added to the cost of production as nearly as possible in accordance with the facts in that shop. In a very small shop, particularly if it is making only one product, there would be no serious inaccuracy in having one rate for the whole shop, or possibly two or three rates; but if there are varied working conditions, or if there is a great variety of product, distinctions must be made to get accurate costs.

A correct burden rate in any department will be determined by dividing the overhead or burden of the department by the normal number of operating units, that is, the normal man-hour or machine-hour capacity of the department or production center.

Great care should be taken to see that the calculation of a burden rate is made on the basis of operating units that can be realized with ordinary good management, if a shop has a steady volume of business, but not considering a night shift or overtime. It is not easy to say just what per cent. of the theoretical hours should be taken as the standard for the purpose of setting burden rates, but allowance should be made for those shut-downs of a department (or a particular tool) repairs, absent workmen, etc., which occur under normal conditions. At this point in the calculation no allowance should be made for shut-downs resulting from lack of orders.

All of the work done in the shop should uniformly carry the normal rate of burden, not more when the shop is partly idle, and not less when it is unusually busy. This arrangement gives costs which are comparable at all times and which vary only in proportion to operating efficiency. This idea of a normal rate of burden is fundamental to good cost accounting, and is particularly important in an industry subject to such ups and downs of production as the manufacture of machine tools.

POINTS BROUGHT OUT

That a proper job order system, showing the cost of the work, material, direct labor, and a proper amount of overhead is necessary.

That interest on investment should be included in calculating the cost of manufacture.

That the correct burden rate in any department can be determined by dividing the overhead by the normal number of operating units, that is, the normal man-hour or machine-hour capacity

That spoiled work should be handled in two ways. First—let the spoiled work all stand as part of the cost of the job, and to let the good pieces absorb this cost. Second—to subtract all the material, labor, and burden cost on the spoiled pieces from the cost of the job, and charge this total, less any salvage value of scrap as a factor of overhead.

According to this plan, when the shop is busy all of this burden will be "earned," as indicated by rectangle 41, and thus be carried into work-in-process, rectangle 44. When the shop is operating on part time, a corresponding portion of the burden will be unearned or unabsorbed, and will therefore go directly to loss and gain, as indicated by rectangle 51.

What Kind of Rate to Use

A rate-per-cent.-on-wage-cost as a method of distributing burden is acceptable only when the wages of all the operatives are very uniform, and when the facilities at their disposal are likewise uniform. As these conditions are rarely present in a machine shop, the rate-per-cent.-on-wage-cost is not a satisfactory method of distributing burden in this industry.

The use of a man-hour-rate removes the inequalities which arise by reason of varying earnings on the part of the operatives, and recognizes the fact that burden corresponds much more nearly to the number of people employed than it does to the wages which they earn.

Under some conditions the man-hour rate will be a satisfactory method of distributing shop burden, but generally the facilities with which the men work will vary so greatly that thoroughly accurate costs cannot be secured without the use of a machine-hour rate, which will be greater or less for different machines (a) according to their size, and therefore the space they occupy; (b) according to their value, and therefore the fixed charges which they should carry (interest, taxes, insurance and depreciation), and (c) according to the power which they use, and therefore the amount of power cost which should be included in the burden rate.

The comparison of actual hours with standard hours may be made a very important factor in securing economical administration. For many years past, shops with the strongest management have had daily operation reports, summarized at frequent and regular intervals, accounting for all idle time of their machines. Some of this idleness will be recognized as inevitable; but in order to fix the standard hours a record of this kind needs to be kept, and in order to reduce to a minimum the loss resulting from idleness, this record needs to have consistent executive attention. If this is done, the management frequently gets an important reflection of the efficiency of the various departments in advancing a job from one operation to the next, not to mention the efficiency of the purchasing agent, storekeeper, employment department or planning department who may have to do with material being on hand in the first place, or men being on hand and at the right time to take care of it. This is a very good example of the kind of analysis which, if correctly made and correctly used, puts money into the pocket of the management.

Separate Kinds of Business

Some members are engaged in other kinds of business in addition to the manufacture of machine tools, in which case the idea of a separate statement of gross profits applied to different lines (of machine tools) should be extended to apply with even greater emphasis to the different kinds of product manufactured. One member, for example, is making agricultural implements as well as machine tools, and several members are doing more or less business in the manufacture of automatic machinery parts.

Distinctions of this kind will be recognized and agreed to as soon as they are stated, and the same idea applies to the operation of a foundry or to a pattern shop if either one is run in connection with a machine shop; for many machine tool manufacturers get along without either of these departments. If a foundry is operated, the castings should be charged to the machine shop at a fair commercial price, so that the executives may know whether they are making or losing on the foundry, and so that the cost of the machine tools may not appear to be greater or less on that account.

Spoiled Work

Spoiled work will always be a subject on which there will be a considerable division of opinion as to how it should be treated. In general, the two plans for spoiled work are (1) to let it all stand as

part of the cost of the job which is being done, and to let the good pieces absorb all this cost; or (2) to subtract all the (a) material, (b) labor, and (c) burden cost on the spoiled pieces from the cost of the job, and charge this total, less any salvage value of scrap, as a factor of overhead or burden.

The first plan would properly be followed in an industry like drop forging or custom stamping, where the successive pieces are individual, and might have such peculiarities of design as would make more spoiled work in some cases than in others; for certainly it would be fair to treat any spoiled work which was a peculiarity of the pattern, in that way. In an industry where spoiled work is not a factor of design in any way, but merely reflects careless workmanship or other errors in the shop, and is, therefore, about as likely to occur on one piece as another, it is better to adopt the second plan and set up the net cost of spoiled work as a burden factor where it occurs.

In either case, the importance of spoiled work should be recognized, and spoiled work reports should be required showing all the particulars, including among other things the exact point at which the damage was done, if that can be determined, whatever details the management wants in the way of administration or discipline, and of course the cost of the spoilage.

The objection to letting the good pieces, however few they may be, take up all the cost of the work done on the job is that when this is done the factor of spoiled work is introduced into cost comparisons, so that if a part is made three or four times during the year, the comparison which is naturally desirable as to material, labor and burden cost on the part is to a considerable extent disturbed, and may be entirely destroyed, if the spoiled work factor is not eliminated.

Drawings, Patterns, Jigs and Fixtures

During the discussion of the accounting practice to be recommended for the industry great emphasis was laid on the accounting for drawings, patterns and jigs and fixtures; and we understand that the executive committee is unanimous in recommending (a) that everything in the nature of repairs to restore worn or damaged pieces should in all cases be charged as an expense, (b) that the cost of new drawings, patterns and jigs and fixtures, not replacement, should be carefully separated from all other costs and (c) that these outlays should preferably be immediately charged as an expense in the year in which they occur; but under no circumstances should the expense be spread over a longer period than three years. The idea is to recognize these items unqualifiedly as an expense, and if they are not charged out currently as they occur, they should be considered like other deferred charges to operating.

Supplies, Small Tools, Etc.

Considering miscellaneous shop expenses, it was thought desirable to emphasize the fact that such items as oil, waste, emery cloth, sand paper, emery wheels, paint brushes, oil cans, brooms, casehardening compound, hardening pots, hack saws, small drills, etc., should be treated as supplies and charged to expense as issued.

Perishable tools, including hammers, wrenches, screw drivers, chisels, reamers, larger drills, taps and dies, hobs, milling cutters, counter-borers, slitting saws, cut-off saws (both band and circular), broaches, and tools with a cutting point, etc., came in for a good deal of discussion. The best practice seems to be to charge these items to expense as issued, exactly like supplies; but many companies carry an asset for items of this kind intended to represent in a conservative way the investment which they have in such articles, and this asset should never be increased, except possibly in connection with a marked expansion of the business. Plans of inventorying perishable tools at regular intervals on a very conservative basis, or any systematic plan of depreciation at a high rate (50 per cent. was suggested) are acceptable, provided anybody feels that the plan of writing off the cost of these items as issued makes the charge to operating too uneven.

Belting was discussed at the same time with perishable tools, and it is recommended that charges for belting be handled on a plan in all respects similar to that recommended for perishable tools. Even where belting is given a steady care it should not be expected to have a life of more than four or five years; and if treated as an asset and subject to depreciation, a rate of 25 per cent. is recommended.

More permanent tools such as micrometers, calipers, test plugs, gauges, boring bars, vises, milling machine arbors, electric drills, pneumatic hammers, etc., may perhaps deserve a different treatment, but if set up as an asset should be depreciated so as to be written off over a period not to exceed three years.

Regarding supplies, perishable tools and permanent tools, it should be understood that these are to be set up as an asset when purchased, carried as an asset so long as they remain in the storeroom, but charged out to expense or otherwise when issued. This practice operates to distribute the cost of these items to correspond with the way they are put into use, and under most conditions will make a satisfactorily even spread of this item of expense.

Repairs

Before considering the depreciation of other assets used in the machine tool industry, it should be understood that repairs of every kind are to be charged to expense as incurred. In this connection it may be well to note that whenever men are engaged on repair work, whether regular machinists, diverted to repairs instead of production work, or men from the regular repair crew, the charge for the repair work they do should include not only the wage rate of the men concerned but also an overhead or burden rate on a man-hour basis. Only when repairs are calculated at full cost in this way do the repair charges of the respective departments and production centers appear correctly; and as repairs are frequently an important factor in fixing a burden rate, it is highly desirable that they be stated correctly.

This idea of a full and correct statement of repairs is also important as applied to the costs of separate departments, like a foundry or pattern shop, which may exist in connection with some machine tool plants, but be entirely absent from others. It is also important in connection with an auxiliary department, like the boiler house or the power house, where repairs are likely to be heavy; or a storeroom, hospital or some other department which correct accounting requires should have its charges separately and fully stated, that the total may be distributed correctly over the departments served.

Depreciation and Obsolescence

Proceeding from this general statement regarding repairs to a consideration of depreciation, the next point to consider is that depreciation rates may and should take into account obsolescence; that is, a charge in addition to wear and tear, in the expectation that the asset may not continue to serve its intended purpose until it is worn out, but (a) that it may be outgrown by the size of the business, or (b) by the need for moving to another location, or maybe (c) superseded by a design that is more economical and efficient, so that the business cannot afford to continue to use the original assets.

With this explanatory statement in regard to repairs, and the basis for calculating depreciation, the minimum rates recommended by the executive committee are as follows: Concrete buildings 2½ per cent., brick buildings (mill construction) 4 per cent., wooden buildings 6 per cent., machine tools 10 per cent., transmission (line shafting, hangers, pulleys) 15 per cent., electric motors 10 per cent., overhead travelling cranes 10 per cent., all other boiler house, power house, electrical, plumbing, heating, lighting and ventilating equipment 10 per cent., motor trucks—heavy 20 per cent, light 30 per cent., passenger cars 30 per cent., office furniture 15 per cent., office mechanical equipment 25 per cent., shop furniture, such as racks, bins, benches and trucks 25 per cent.

These rates are to be calculated upon the first cost of the asset, and set up annually in Reserve for Depreciation account. It is recognized that in the present deflating movement, assets may suffer marked declined value through price recession. Such a revaluation would have to be taken care of in a special way.

Information Wanted on the Subject of Fits

IN July, 1920, the journal of Mechanical Engineering announced the organization and personnel of the Sectional Committee on Plain Limit Gages for General Engineering Work, a Sectional Committee which is working under the Rules of Procedure of the American Engineering Standards Committee and is sponsored by the American Society of Mechanical Engineers. After a preliminary canvass of the gaging situation carried on during the summer months, the committee subdivided itself into three working sub-committees. To these sub-committees have been assigned the three subdivisions of the subject, viz., (a) standards and tolerances for manufactured material; (b) methods of gaging manufactured material; and (c) gages and their limits, manufacture and use.

The Sub-Committee on Standards and Tolerances for Manufactured Material, to which has been assigned the task of preparing a set of standard allowances and tolerances for mating parts in interchangeable manufacture, has after considerable discussion and consultation with manufacturers prepared a questionnaire, full and complete, answers to which it earnestly requests. Since by the method of its organization the report of the full committee when approved by the A.E.S.C. will establish American standard practice, it is very desirable that everyone interested in any way in this set of standards should know of this activity and should have a part in it, if he so desires. Canadian Machinery therefore takes pleasure in reprinting this questionnaire in full and invites its readers to send their replies to our editor, who will in turn forward them to the committee. It is only by relating our experiences that we can help others.

For the purpose of clearness and after very careful consideration, the committee has subdivided all machined fits into four classes. These are listed below with the kinds of work which seem to fall in each class.

Class No. 1—Loose Fits

Machined fits of agricultural, domestic and other machinery of similar grade (wagons excepted).

Mining machinery.

Controlling apparatus for marine work, etc.

Textile and rubber machinery, candy and bread machinery and others of similar grade.

Some parts of ordnance.

General machinery for manufacturing.

Question 1.—What allowances do you make in this class?

Class No. 2—Medium Fits (Moving Parts)

2a. High Speeds (over 600 r.p.m.) and Heavy Pressures.

Electrical machinery.

High-speed parts of woodworking machines.

Sewing machines.

Machine tools.

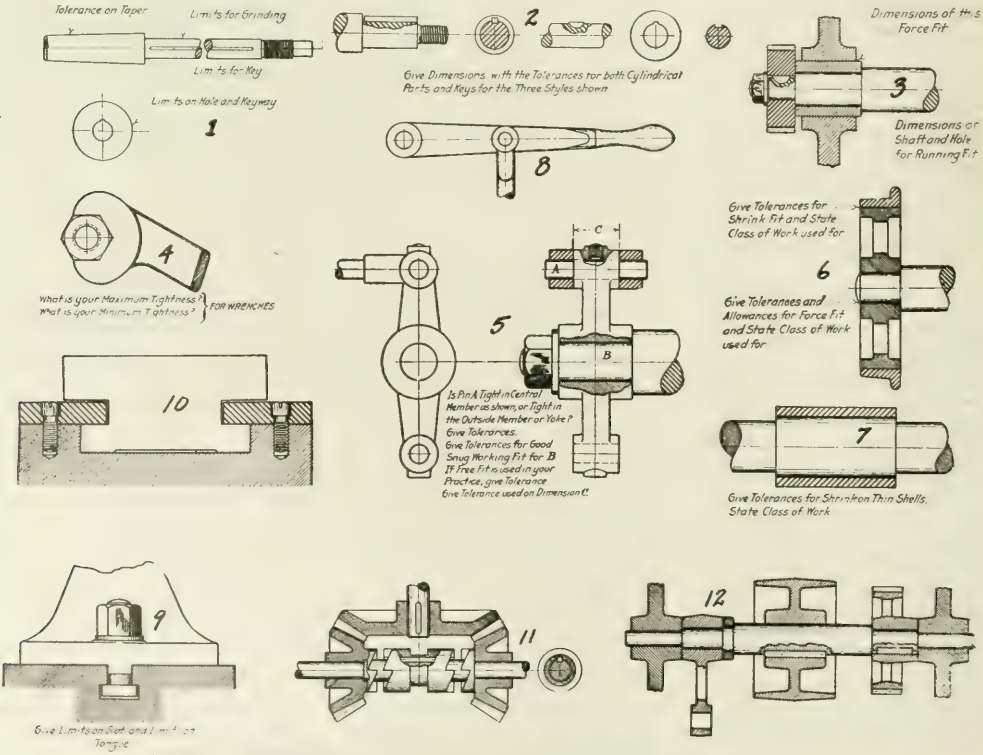
Locomotives.

Printing machinery.

Automotive.

Ordnance.

General machinery for manufacturing.



LET US HEAR FROM YOU REGARDING THE VARIOUS QUESTIONS ASKED.

A well-known firm uses allowances of 0.0005-0.004 inch up to 6 inches for work of this class.

Question 2.—How does this compare with your practice?

Class No. 2—Medium Fits

2b. Ordinary Speeds (under 600 r.p.m) and Light Pressures.

Machine tools.

Printing presses and machinery.

Typewriters, calculating machines, etc.

Locomotives.

Automotive—general parts.

Textiles, rubber machinery.

Ordnance.

General machinery for manufacturing.

A well-known firm uses allowance of 0.0005-0.0025 inch up to 6 inches for work of this class.

Question 3.—How does this compare with your practice?

Class No. 3—Snug Fits

(Designated as the closest fit that can be assembled by hand.)

3a. Slight Allowance (0.00025 to 0.00075 inch.)

Gear trains and change gears for general work.

Mating parts, fixed or not, moving on each other, such as studs for gears and levers, keys.

General machinery for manufacturing.

Question 4.—Do these allowances agree with your practice?

3b. Close Fit (commonly known as wringing fit, no allowance, not considered interchangeable manufacturing but selective assembling).

Crankshafts.

Precision-ground machine spindles.

Gears in index train of precision gear-cutting machines.

Slots and tongues such as are used for grinding machines, milling machines, etc.

Surveying and scientific dental instruments, etc.

General machinery for manufacturing.

Question 5.—Should no allowance be made in machining the fits in this class?

Class No. 4—Tight Fits

4a. Drive Fits for Light Sections.

Automotive.

Ordnance.

General machinery for manufacturing.

A well-known firm uses negative allowance from 0.00025 to 0.001 inch up to 6 inches.

Question 6.—How does this compare with your practice?

4b. Force Fits for Heavy Sections.

Locomotive and car wheels.

Crank discs, armatures, flywheels.

Automotive.

Ordnance.

General machinery for manufacturing.

A well-known firm uses negative allowance from 0.00075 to 0.005 inch up to 6 inches.

Question 7.—How does this compare with your practice?

4c. Shrink Fits.

Locomotive tires and similar work.

Ordnance.

A well-known concern's practice is as follows: Where thickness exceeds ⅜ inch, 0.0005 to 0.005 inch up to 6 inches diameter. Where thickness is less than ⅜ inch, up to 6 inches in diameter, 0.00025 inch to 0.0015 inch.

Question 8.—How does this practice compare with yours?

The committee would greatly appreciate having your full answers also to the three following general questions with as much explanatory information as possible:

Question 9.—How many of the four kinds of fits previously mentioned apply to your work?

Question 10.—Will you send the committee blueprints or other data showing your practice in as many of these cases as possible?

Question 11.—How do you specify both allowance and tolerance for mating parts—such as a solid 2-inch bearing and the shaft which runs into it?

The following sketches show some of the problems. Will you kindly give the committee as much information as possible regarding your practice in such cases.

Question 12.—What allowance and what tolerance would you give on such a piece as shown in Fig. 1: (a) for a milling-cutter arbor, (b) for a work-holding mandrel?

Question 13.—What allowance and what tolerance would you give on the keys and keyways shown in Fig. 2, where

(a) Keys are tight in both shaft and hub;

(b) Keys are tight in shaft—sliding in hub;

(c) Keys are tight in hub—sliding in shaft?

Question 14.—What difference in allowances and tolerances would you give on the bearing and gear fit shown in Fig. 3?

The fit of a wrench is shown in Fig. 4.

Question 15.—What is your practice as to allowance and tolerance for maximum looseness and maximum tightness?

The rocker arm shown in Fig. 5 contains several kinds of fits.

Question 16.—What allowance and tolerance would you give at A, B and C?

Two shrink fits are shown in Figs. 6 and 7, one a thin shell, the other a locomotive tire. The latter also has a press fit.

Question 17.—What is your practice on work of this or a similar character?

In multiplying movements the lost motion often plays an important part.

Question 18.—What is your practice in such cases as shown in Fig. 8—for both allowance and tolerance?

Fig. 9 shows a light sliding fit for accurate grinding or simialr work. Fig. 10 illustrates a working slide fit for turret slide or for similar purposes.

Question 19.—What are your allowances and tolerances in such cases?

Question 20.—Do they vary with the length of the slide?

The two remaining sketches, Figs. 11 and 12, show combinations which occur frequently in machine design.

Question 21.—Will you kindly give your practice in such cases?

Please bear in mind that this committee has no desire that its report shall impose arbitrary standards in any case. Its first work consists in securing data as to the best present practice in this country, with the sole aim of aiding interchangeable manufacture in every way possible. Your co-operation will aid greatly in reducing manufacturing costs in many places and in improving our already high standards of manufacture.

PAINT FILLERS FOR CAST IRON WORK

Where castings have to be painted and varnished to give them a smooth and glossy finish, it is necessary to give one or more filling coats of thick paint made with some inert mineral and a drying oil medium such as a double-boiled linseed oil and turpentine plus the required driers for the quantity of oil used. Finely-ground slate or other soft and cheap mineral body answers very well, and gives a thick hard substance when dry, and one which will take the finishing paint well. Applied in a warm place, the first coat should be dry in a couple of days, when it should be rubbed level with glass paper and a second coat put on. When this is dry and hard it should have the surface rubbed smooth with fairly fine glass-paper, and after all dust has been carefully removed the finishing coat should be put on, for preference this being a hard-drying enamel paint which does not require varnishing. If, however, remarks Practical Engineer, an ordinary paint is used, it should be allowed to become thoroughly dry and hard, and then, after rubbing down with fine glass-paper, it should have a good coat of hard and tough copal varnish put on, this giving a glassy surface when dry and hard. All painting and varnishing should be done in a dry place free from dust, where the temperature can be kept at anywhere between 60 deg. and 75 deg. Fah., while proper time must be allowed for the work, it being very undesirable to apply paint or varnish until the preceding coat is thoroughly dry and fairly hard. All grease should be cleaned off metal before paint is put on, and where strong alkaline washes are used for this purpose the work should be rinsed off with an acidulated water to fully neutralize the alkali.

WELDING AND CUTTING

Oxy-Acetylene Welding of Iron and Steels

Preparation of Parts--Selection of Blowpipe Tip—Preheating—Welding Rods and Flux—Execution of Welds, and Treatment After Welding

THE welding of iron and steels is at all times an interesting study. By iron and steels we mean commercial wrought iron, and mild or low carbon steel.

The operator will be able to work more intelligently if he knows something of the composition and nature of these metals. Iron, as a material of construction, is no longer used. Practically all of the so-called "wrought" iron on the market to-day is in reality a mild steel. For this reason wrought iron and mild steel metals are discussed as one. "Low carbon" or mild steel is quite ductile and malleable, but has a lower tensile strength and lower elastic limit than the "high carbon" or hard steels. No close distinction can be made between high and low carbon steel, but in general anything below 25 point carbon (0.25 per cent.) may be designated as mild steel, while those containing more than this amount are either half hard or hard. Most of the steels that the operator will be called upon to weld are mild.

Preparation of Parts

Mild steel parts are prepared in the manner described in February 24 issue. Several methods of preparing various parts to be welded are shown in the accompanying illustrations.

Fig 1 shows a section of one side of a steel cylinder and a convex head which is to be welded on. The weld should be made in the straight portion of the cylinder as shown, and not directly at the bend. Fig. 2 depicts the method of accomplishing the same result in the case of a concave end. If the parts are bevelled as shown, the joint will be a strong one.

Fig. 3 illustrates the proper method of preparing shafting up to two inches in diameter for welding. Note that this is bevelled to a chisel edge and not pointed. If the shaft is pointed (see Fig. 4), the molten metal will fall upon the cold part of the shaft and adhesion will result, which means that the new metal is merely "plastered" on at certain points and is not "fused."

Fig. 5 shows the proper method of bevelling a shaft over two inches in diameter. At the bottom of the bevel, the angle is large enough to insure a good weld. It is unnecessary to continue this wide angle clear to the top, however. The opening at the top should be approximately equal to the radius of the shaft.

In welding two plates it is necessary that the edges to be welded diverge as shown in Fig. 6. The amount of this divergence is dependent to some extent upon the thickness and nature of the metal. It is safe to say, however, that this divergence must not be over six per cent., nor less than 2½ per cent. of the length of the weld. Some operators stick by the hard and fast rule of ¼ inch

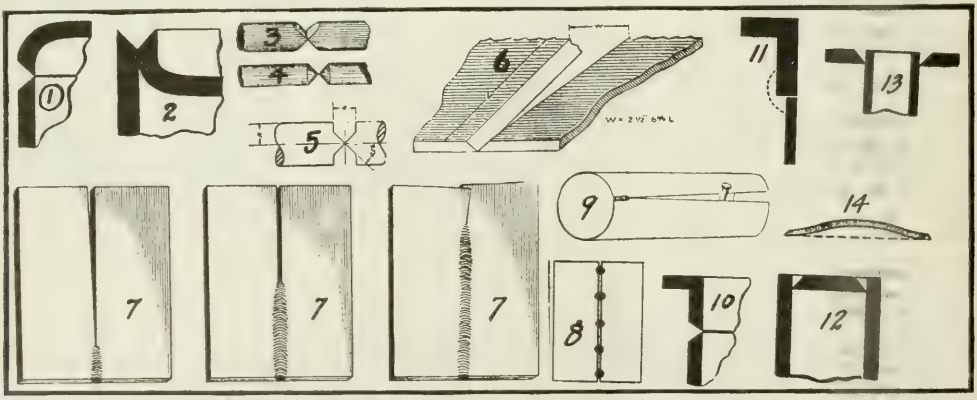


Fig. 1—Joint for convex end on cylinder. Fig. 2—Joint for concave end. Fig. 3—Correct method of preparing shaft for welding. Fig. 4—Incorrect method. Fig. 5—Method of beveling shaft over 2" diameter. Fig. 6—Sheets spread for welding to allow for draw. Fig. 7—Effects of not spreading sheets. First they spread, about the middle they close again, and beyond the middle they draw and lap.

Fig. 8.—Sheets tacked before welding. Fig. 9.—Wedge inserted between edges to prevent overlapping. Fig. 10—Joint for angle iron and sheet of the same thickness. Fig. 11—Joint for angle iron and thinner sheet. Fig. 12—Joint for flat end in tube. Fig. 13—Joint for flange in tube. Fig. 14 Patch plate bellied, and edges beveled.

per foot. This is a fairly good figure. Yet, to obtain the best results, certain deviations from this proportion should be made. In making a butt weld of two plates, the edges of which have been placed in contact with each other for their entire length, they diverge at first and then gradually come together until after about half of the weld has been made, when they will be parallel again. From this point on they will start to converge until there is an overlapping, as shown in Fig. 7.

There are two methods of overcoming this. First, by diverging the plates the proper amount. Second, by tacking or spot welding the joint at various points, Fig. 8. The second method has the disadvantage of causing warping or buckling under certain conditions. In a number of cases the warping or buckling can be eliminated by rolling or hammering after the piece has been welded. The first method is by far the most satisfactory, and after the welder has had practice he can accurately calculate the amount of divergence that the plates will need in order to bring the edges of the weld exactly together at its completion.

Another method of preventing overlapping of the plates, in the case of cylinders, is to insert a wedge a short distance ahead of the weld, moving the wedge as the weld progresses. This is shown in Fig. 9. When welding angle iron rings to cylinders where the thicknesses are the same, both edges should be set up as shown in Fig. 10. When the angle to be welded to the plate is thicker than the plate (Fig. 11) apply the flame more on the angle than on the plate. This will tend to bring the parts to the fusion point at the same time. Metal must be added as shown by the dotted line.

When welding a flat end into a tube, prepare the end as shown in Fig. 12, making a driving fit. The welding of flat flanges to tubes is an operation that requires care, as the flange is usually considerably thicker than the tube and has to stand a good deal of strain. The flange and tube are best prepared as shown in Fig. 13. The welding flame should play more on the flange than on the tube.

When repairing cracks in plates, always see that the crack is bevelled through its entire thickness. The plate being welded should be free to move. If it is impossible to provide for this, instead of attempting to repair the crack use a patch. A patch piece should always be slightly bellied and have edges bevelled as indicated in Fig. 14.

The size of tip to use for welding iron and steel depends upon the thickness of the metal, but do not forget that the flame should be neutral at all times.

Preheating

Preheating is usually unnecessary since iron and steel are elastic enough to take up expansion and contraction without breaking. However, in welding heavy sections, preheating will save 30 to 50 per cent. in gas consumption and labor, as the welds can be made faster on previously heated metal. For filling material in the case of work that is not under tension, use pure iron wire of the first quality to get the best results. This is free from slag, sulphur, phosphorus and other impurities. It should be remembered that pure iron has a comparatively low tensile strength. However, it is very ductile (elastic) and hence is very suitable for welding. Welding rods used on iron or steel should never exceed ⅜ inch in thickness. For thin work never use a rod thicker than the metal to be welded. The use of a flux is not necessary in welding wrought iron or steel. The general instructions already given apply in the welding of wrought iron and steel. The end of the small white cone should be allowed to just touch the metal.

This information will be continued in later issues, and we will take up the subjects of irons and steels, pipe welding, cast iron, etc. We are indebted to the Oxweld Acetylene Co. for the use of this material.—EDITOR.

Annealing or hammering, or both, will improve the quality of steel welds. Welds preferably should be treated in this manner wherever great strength is desired. The hammering should be done with the metal at a yellow white heat. Hammering at a dull red heat is likely to produce cracks or fissures in the welded portion. Before hammering, it is necessary to reheat the work thoroughly to the proper color. The welded part may then be annealed by heating to a cherry red heat and allowing to cool naturally.

Special Steels

There are many special or alloy steels used in the metal industry. The operator is often called upon to weld these. Many automobile and locomotive parts are made from special alloy high carbon steels, and these castings or forgings undergo, during manufacture, special heat treatments which are in many cases more or less of a secret process. It will be appreciated that welding with a high temperature flame must necessarily counteract the effects that were produced by the heat treatment, consequently to make the part 100 per cent. efficient it is essential that after welding the piece be properly heat treated by an operator skilled in such work. The services of such a man are rarely available, therefore the results obtained when welding high carbon alloy steels will be uncertain. Fortunately, however, many of the alloy steels used in practice are not high carbon and can be welded satisfactorily. Manganese steel (low carbon) is welded quite readily. The manganese acts as a deoxidizing agent, that is, it counteracts the effect of burning the metal. If possible, use a filling material of the same composition as the part welded. If this cannot be obtained use pure iron.

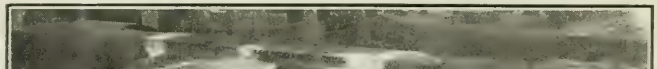
Nickel steel (low carbon) can be welded without difficulty in exactly the same way as mild steel, but nickel steel welding rods must be used. Vanadium steel (low carbon) is probably the most commonly used steel alloy. Very fortunately it is extremely easy to weld, and flows much more readily than ordinary mild steel. Weld as mild steel, but use vanadium steel welding rods.

Chrome steel, if in the class of mild or low carbon steel, can be welded readily. Weld as mild steel. Use a nickel or vanadium steel welding rod. Many chrome steels, however, are in the high carbon or hard steel class and the general remarks on "special steels" apply.

STEAM SHOVEL REPAIR

It is a well-known fact that a steam shovel is subjected to severe working stresses. For this reason, if for no other, the illustration and description should be of interest.

The end sill casting of one of these shovels gave way. It cracked in a dozen or more places and some of the pieces were small fragments that broke out and were lost. To replace the broken casting with a new one would have kept the equipment idle for several weeks. However, a new casting was out of the question, as the work had to proceed, so the cracked and broken casting was shipped to the Oxweld Setelyene Co., Newark, N.J., and was repaired, as shown, in short order. The saving in time alone is said to have replaced the repair expense.



VIEW SHOWING THE WORK COMPLETED.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.

The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

George Land, 567 Patterson St., Peterborough, Ont., is the prize-winner for March 3rd issue. All his answers were correct. Other readers came mighty close to a correct list—but—there was only one perfect list. This is the second scale George has landed, so it's up to the other contestants to dig in and show him he can't get them all.

CONTEST FOR MARCH 24TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something which uses up double energy and which you are advised not to use.

2—Something of interest to gear users, that can be obtained free.

3—How to secure increased production, and minimum depreciation.

4—Something said to have exceptional fitness.

5—That it is possible to do two things at the same time.

6—Something you can procure without obligation.

7—How to make sure you are getting full value for every cent you spend.

8—Something that is always under air pressure.

9—Certain points in construction that are embodied as characteristics to a particular line of machine.

10—A product designed to give rapid accurate production.

11—Something that uses no electricity, and has perfect constancy.

12—A product that will operate against 100-lb. pressure.

These are Correct Answers for List from March 3rd Issue:

1—Northern Electric Co.
2—Hans Renold of Canada Ltd.
3—American Lead Pencil Co.
4—Nicholson File Co.
5—W. S. Rockwell Co.
6—Wisconsin Electric Co.
7—The Bristol Co.
8—S. F. Bowser Co., Ltd.
9—The Acme Machine Tool Co.
10—The Royal Bank of Canada.
11—Landis Machine Co.
12—The Burke Machine Tool Co.

Closing Date for This Contest is April 14th.

Proper Heat Treatment Means Quality Work

STEEL TREATERS and mechanical engineers of the Toronto district were given a distinct treat on the evening of March 18th, when G. W. Tall, Jr., of the Leeds & Northrup Co., Philadelphia, spoke on the Hump method of heat treatment. Mr. Tall proved a very very capable speaker, and brought out some valuable points to all interested in heat treatment of steels. His lecture was well illustrated, some 60 slides being shown, many of these covering intricate forms of dies that were treated by the Hump process.

As he so aptly put it, "Steel treatment is demanding and receiving more attention lately than at any time in our industrial life—and yet there is a great chance for improvement. The larger shops realize the advantage of using some proven method of heat treatment, but unfortunately many small shops have yet to be convinced. The initial cost is sometimes the stumbling-block, then again the excuse may be that the hardener is getting along well enough with his present system, which unfortunately is usually the guess and guess again method."

He blamed steel treaters themselves for a lot of their trouble. "Can you imagine a good toolmaker using some old broken-down lathe to produce first class work?" asked Mr. Tall. "Of course not, for he would tell his foreman it couldn't be done. Then again, give a toolmaker a pair of calipers and a micrometer, and a number of similar pieces to make. Will he get them as accurate with the calipers as he could by using the micrometer? Again the answer is no. Well then, how can a steel treater expect to get the best and most accurate results if he does not use proper equipment. The trouble lies chiefly in the fact that the steel treater in general belittles his calling by trying to use some makeshift apparatus, the result being that he has showers of abuse poured upon him on occasions when he is not at fault. Of course he has no excuse for he has no record to prove what he has been doing. Thus, he is continually in trouble, although indirectly he himself is responsible for that trouble."

To those readers who are not familiar with the Hump method of heat treating we append the following:—Briefly, this system gives unmistakable indications when the work has reached the critical or transformation point, this being used as a reference point for quenching. The system also insures uniform temperature at all points of the work. Distortion due to unequal expansion is practically eliminated, and spoiled work is almost unknown. It also gives accurate control of, and information regarding the rate of heating, and permits of a maximum rate of heating without injury to the work. A record of each work charge is made and preserved for future reference. In other words, guess work is eliminated, and scientific control substituted.

Heating is done by electric furnaces, and one advantage, as pointed out by Mr. Tall, is the fact that owing to low radiation externally, the heat treating equipment can be installed right in the manufacturing plant without discomfort to surrounding workers. This feature also eliminates extra trucking, and allows a better system of routing. The space occupied is comparatively small, this also being of considerable importance. Of course, there is no smoke or noise, as the electric system is both clean and noiseless.

The number of furnaces that can be handled by one man, varies according to the system installed. Usually one attendant can handle three furnaces, but if the volume of the work warrants it, a central station is aranged, and all furnaces, no mater what the quantity, are brought under the control of one man. He cannot make a mistake if he is a capable workman, for his charts tell him all he needs to know. The advantages of scientific control were, as the speaker pointed out, "High Quality, uniform and accurate results. Not only that, but the same results were duplicated every day for the preceding records were a guide, while on the other hand, the recording chart in connecting with each furnace guaranteed results."

Some interesting examples of installations were shown on the screen, some of these being large automotive plants who used both the hardening and drawing furnaces, for gears, shafts, etc. To explain the system in its entirely would take considerable space, but we have arranged at a later date to present in full this method of heat treatment. The story which will be presented will be well illustrated with examples of work performed, and we shall show a sectional view of the furnace explaining the principal features of design.

After the lecture, the speaker was the target of a bombardment of questions. He was able to answer satisfactorily all queries however, and here are a few which are worth repeating.

In hardening files, a good method is to make special holders to accommodate a number of files at one time, quenching these in a vertical position.

In hardening taps and reamers, a good plan has been adopted. A circular form of pipe is arranged with a series of holes on the top, into which are placed the taps or reamers. In this position they are lowered into the furnace, also quenched.

A small outfit, that is for a small average shop would cost approximately $600, and larger equipment would run proportionately. This figure includes everything, even to service.

Large die blocks, up to the capacity of the furnace are handled with equal ease and with the same uniform results as pieces of light section. This statement was proved by a slide which showed the rate of expansion of the thick and thin sections of a piece being heated, and these rates were practically similar. In other words, there were no stresses conflicting in the piece, owing to one part expanding, while another was trying to contract.

In summing up his talk, Mr. Tall emphasized the need of education of employers as well as employees as to the value of proper heat treatment. Let steel treaters get together for the sake of the art and show the trade generally the benefits of scientific control of heating. Prove that uniform heating means better dies, which in turn means added production, and you've started the ball rolling in the right direction. Do not let the matter rest because the results you are obtaining seem splendid. Make sure they are the best you can secure. To prove the latter mentioned point, he quoted the story of one firm who were well satisfied with results obtained by ordinary methods, but since adopting the Hump method had increased the efficiency of their dies, not 100 per cent.—but 1,000 per cent. Naturally figures like these give us cause for thought, for after all we are all willing to invest our money if it is returned in such proportions as the above case.

THINGS TO REMEMBER

Steel treaters are often responsible for their own trouble. The best of work cannot be secured with poor equipment.

Scientific control of the heat means high quality, uniformity, and accurate results.

That a good method to harden taps is by means of a special circular holder.

That the rate of expansion and contraction is very important.

Fitzgerald & Kent, 232 King Street East, Hamilton, Ont., are contemplating the erection of a storehouse on Young Street.

DEVELOPMENTS IN SHOP EQUIPMENT

NINE-INCH SHAPER

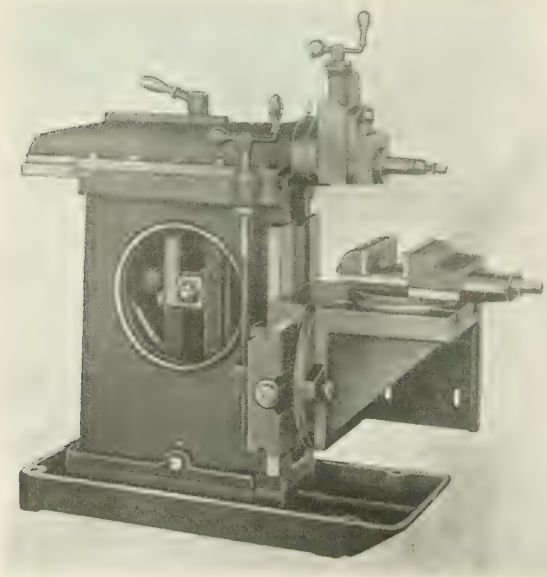
Carl Pletz & Sons, Cincinnati, Ohio, have placed on the market a 9-inch shaper as illustrated.

This machine has been designed to meet the demand for a sturdy and accurate tool with the necessary range and extra features to handle the general run of shaper work in the tool room, die shop and experimental shop. Due to its sturdy construction, it also has its field as a manufacturing tool on small work and is said to be able to handle most of the work now being done on larger shapers with more speed and less power consumption.

The ram is heavily constructed with extra wide and long bearing surface. It can be set to any length stroke within its range. The graduated scale on the rocker arm shows the stroke at a glance. Bearings are fitted with felt oilers, insuring constant lubrication. The column is rigid, with an extra heavy wall of metal all around and is flanged out at the bottom where it bolts on the base. The ram-way is fitted with taper gib, adjustable for wear. The cross rail slides on a wide bearing on the column, is gibbed securely, with provisions made to take up the wear.

The swivel table is of the box section, bolted to the saddle with four bolts and swivels at any angle. It is graduated in degrees, the graduations being large enough to set at fraction of a degree. A dowel pin locates the table at zero. The automatic feed is in either direction and can be varied to suit.

The drive is by cone pulley, which runs on a sleeve taking the belt pull off the pinion shaft. Gears are accurately cut and the main bearing is bronze bushed with oil reservoir, insuring constant lubrication. The vise is heavily constructed with hardened steel jaws. The base is graduated and can be swiveled at any angle. Standard equipment includes universal table, two wrenches and countershaft. Pedestal can be furnished if desired.



GENERAL VIEW OF THE SHAPER.

HEAVY DUTY LATHE

The Oliver Machinery Co., Grand Rapids, Mich., have placed on the market a 16-inch heavy duty lathe that is simplified to the greatest possible extent so that it can be used as a production lathe. A three-step cone is provided in the headstock, this being of large diameter, with each step wide in face. A large lever in front of headstock operates both starting and stopping of clutch.

The headstock can be supplied with single or double back gears, and four feeds to the lathe are obtained through a quick change gear box. The tool post on the carriage is also of very rugged design. Provision is made for a continuous flow of cutting compound, and the machine throughout is said to be of massive proportions.

COLLAPSIBLE TAP

The Rickert-Shafer Co., 612 W. 12th St., Erie, Pa., has added to its line of threading machines and tools a new collapsible tap. The original and outstanding feature of this tool is the method of withdrawing the chasers when the work is tapped to the required depth. The manufacturers claim that the tap is "positive acting" and cannot stick. This is a decided advantage in all cases of tapping, but will be found especially useful where the work has to be tapped close to the bottom of the hole, as the chasers will be released at exactly the right point.

At the point of release the force of the cut pulls the head from the locking pins and revolves it. This action causes the cams on the core to act and pull the core back, drawing the chasers into the head and clearing them from the work. No dependence is placed upon springs for the purpose of collapsing. The method of making adjustments allows adjustments to be made to thousandths of an inch.

The company guarantees that these taps will hold to size within the most exacting limits, and that sizing hand taps can absolutely be dispensed with when this collapsing tap is used. These taps have hardened and ground wearing parts, accurate chasers, and are chip-proof. They are manufactured in sizes from 1 to 10 inches, or larger, and can also be specially combined with boring, reaming, or chamfering tools, thus greatly increasing production by eliminating additional operations and set-ups.

NEW THINGS IN MACHINE TOOLS

STRAIGHT-SIDE TRIMMING PRESS

The redesigned straight-side trimming press of the Williams, White & Company, of Moline, Ill., adds considerably to the efficiency of the machine. While primarily intended for the trimming operations on drop forgings, the large area of the table and ram face makes it particularly suitable for a large variety of stamping, drawing and other work. The gears are exceptionally large, made of steel and having cut teeth. The automatic-stop jaw clutch has six jaws and is 21 inches in diameter. The thrust end of the pitman operates in a bronze-lined steel thrust block. The press can be furnished either with a belt or motor drive. For the latter the motor is located on a special stand at the left of the machine. Variations from standard dimensions may be made when required.

SPECIAL FURNACE WITH MOVING FLOOR

An automatic feed furnace, specially designed for heat treating purposes, has been constructed by the Advance Furnace and Engineering Company, of Springfield, Mass. The feeding device is operated intermittently, power being supplied at stated intervals either by hydraulic or pneumatic pressure. The movement of the floor is obtained through an electric timing device, and power is required only at the moment the movement is taking place. Furnaces may be made any desired length and the movement of the floor may be long or short as desired. The movement of the work is obtained by means of a horizontal and a vertical cylinder in conjunction with levers and other mechanism. The long rails that carry the work forward are below the level of the floor when in a neutral position. When movement takes place the rails are first elevated by means of a vertical cylinder, this raising the work from the floor of the furnace. When this is accomplished the horizontal cylinder comes into action and the work is moved forward a certain distance, and then lowered again, after which the rails are returned to their former position, until the time for the next movement. The timing device is operated by a small electric motor not more than ⅛ horsepower. The furnace may be adapted to the use of either gas or fuel oil.

SHAFTING CLEANER

A specially designed ring for the cleaning of shafting has been placed on the market by the American Metal Products Company, of Chicago, Ill. The device consists of a number of duplicate pieces of heavy grade nickel-plated sheet zinc, in the form of quarter-circles, four duplicate pieces being used in the construction of each ring, the joints being placed 90 degrees apart, the sections being joined together by means of special staples made of the same material. The cleaners can be placed on shafting already installed, and may be easily removed. A pocket is provided on the inner circumference that is filled with felt that assists in distributing any oil on the shaft.

BABBITT-LINING MACHINE

A special machine for the lining of bronze bushings with babbitt has been placed on the market by the Ideal Tool and Manufacturing Company, of Chicago, Ill. The machine is particularly adapted for use on automobile crank cases and electric motor bearings. A feature of the design is the rapid rotation of the bearing while the metal is cooling, the speed of the spindle being about 1,800 r.p.m. The machine has an approximate capacity of 700 bearings per day. The centrifugal action is said to counteract the contracting action of the metal. The machine is of the triplex type, so that ample time is allowed for cooling each bearing while the operator is charging the others. The machine is fitted with S.K.F. ball bearings, and chuck may be provided to suit the bearing being babbitted. Each spindle is independently operated.

CHAMFERING AND THREADING MACHINES

The Grant Mfg. & Machine Co., of Bridgeport, Conn., have recently added to their line of double spindle automatic chamfering and threading machines, type No. 183, as shown in the following illustrations. The illustration depicts the front of machine, showing the cutter spindles, magazine, work holding and feeding table, etc. The spindle bushings have a lateral adjustment of approximately 2 in., by means of hardened collars shown at A, and are fed to the work by fulcrum levers B, operated by face cams within the body of the machine. The automatic movements are controlled by the lever C.

An oil tank and gear driven pump is provided which feeds suitable cutting lubricant to the tools through pipes shown.

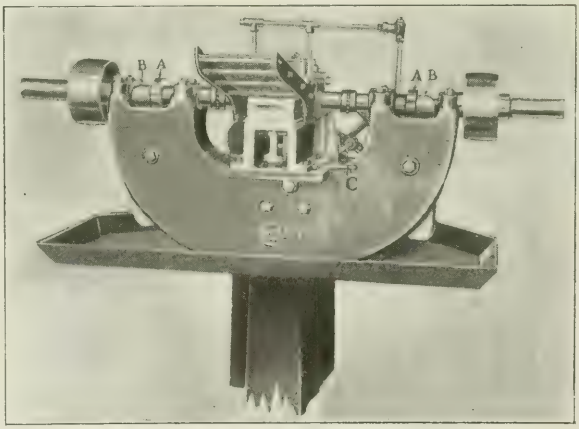
With slight modification the above machine, which is shown equipped for double end chamfering, can be readily adapted for threading both ends of small rods automatically. It can also be equipped with tools to drill and counterbore or countersink both ends at one time.

Ordinarily the work is placed in the inclined hopper or magazine shown, where it is fed by a slide mechanism to the proper machining position. There it is clamped and rigidly held while the work is being done. The finished pieces are then automatically ejected.

The hopper or magazine and feeding mechanism may be modified to suit various kinds of work, such as square, hexagon or other irregular shapes where an operation is to be done on both ends.

ROTARY EMBOSSING MACHINE

Julius Merey, 2842 N. Maplewood Ave., Chicago, Ill., has placed on the market a special machine for the embossing of sheet metal, either in the flat or when formed into cylindrical shape. The machine consists of two heads mounted upon a horizontal bed, one of the heads carrying the embossing rolls and the other head used for the holding of the articles to be embossed. The rolls or the dies are made interchangeable, and the gearing is so constructed that the dies are automatically separated at the completion of the revolution. Provision is made for chucking different sizes of work; the chuck is rotated by means of power derived from the embossing head



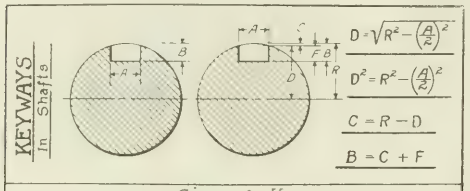
GENERAL VIEW OF CHAMFERING AND THREADING MACHINE.

WHAT OUR READERS THINK AND DO

HANDY TABLE FOR CUTTING KEYWAYS

By R. MAWSON

The difference of opinion that many mechanics have in regard to the measurements of keyways in shafts and pulleys is the reason for the compilation of the accompanying table. A specific case of inconvenience was brought to our attention just recently. We were called upon to construct a certain machine, but owing to the pressure of business we were forced to have a large part of the machining done in outside shops, the various parts coming back to the factory for final assembly. On the drawing the designers, following the usual practice, had specified the keyways as follows: ⅜ inch by 3-16 inch, for example. The outside shops interpreted

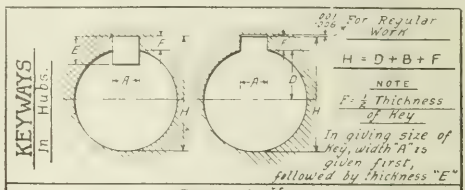


Size of Key.

DEPTH (B)

Size of Shaft.

	3/32	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4
3/8	.0527	.073										
7/16	.0518	.071	.115									
1/2	.0513	.070	.112	.158								
3/4	.0499	.068	.106	.146								
7/8	.0494	.0670	.104	.143	.185							
1	.0491	.0664	.103	.141	.181							
1 1/8	.0489	.066	.102	.139	.178							
1 1/4	.0487	.0656	.1009	.138	.176	.216						
1 3/8	.0485	.0654	.1003	.137	.174	.214						
1 1/2	.0484	.0651	.0997	.136	.173	.211						
1 5/8	.0482	.0649	.0992	.135	.171	.209	.218					
1 3/4	.0482	.0647	.0989	.134	.170	.208	.215	.255				
1 7/8	.0480	.0646	.0985	.134	.0694	.207	.213	.253				
2	.0480	.0645	.0982	.133	.1686	.205	.212	.251	.290			
2 1/8	.0479	.0643	.098	.133	.1678	.204	.210	.249	.288			
2 1/4	.0479	.0642	.0977	.132	.1672	.203	.209	.247	.286	.326		
2 3/8	.0478	.0641	.0975	.316	.1666	.2024	.208	.245	.284	.323	.362	
2 1/2	.0477	.0641	.0974	.1313	.1661	.2017	.207	.244	.282	.321	.360	
2 3/4		.0639	.0970	.1306	.1651	.2003	.205	.242	.279	.317	.356	
2 7/8		.0638	.0968	.1305	.1648	.1998	.2042	.2407	.278	.316	.354	
3		.0638	.0967	.1302	.1645	.1992	.2034	.2398	.277	.314	.352	
3 1/8			.0966	.1300	.1641	.1987	.2028	.2389	.276	.313	.351	
3 1/4			.0965	.1298	.1638	.1983	.2023	.2382	.275	.312	.350	
3 3/8			.0965	.1297	.1636	.1981	.2018	.2375	.274	.311	.348	
3 1/2			.0964	.1295	.1634	.1976	.2012	.2365	.273	.310	.347	
3 5/8				.1293	.1630	.1972	.2007	.2361	.272	.308	.345	
3 3/4				.1292	.1627	.1969	.2004	.2356	.271	.308	.344	
3 7/8				.1292	.1627	.1967	.2000	.2351	.271	.307	.343	
4				.1288	.1623	.1963	.1998	.2345	.270	.306	.342	



Size of Key.

DEPTH (H)

Size of Shaft.

	3/32	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4
3/8	.416	.427										
7/16	.479	.491	.510									
1/2	.543	.555	.576	.592								
3/4	.794	.807	.832	.854								
7/8	.919	.933	.959	1.003								
1	1.045	1.059	1.085	1.109	1.131							
1 1/8	1.170	1.184	1.211	1.236	1.259							
1 1/4	1.295	1.309	1.337	1.362	1.386	1.409						
1 3/8	1.420	1.435	1.462	1.489	1.513	1.536						
1 1/2	1.545	1.560	1.588	1.615	1.640	1.664						
1 5/8	1.671	1.685	1.713	1.740	1.766	1.791	1.783					
1 3/4	1.796	1.810	1.839	1.866	1.892	1.917	1.910	1.932				
1 7/8	1.921	1.935	1.964	1.992	2.018	2.044	2.037	2.060				
2	2.046	2.061	2.089	2.117	2.144	2.170	2.163	2.187	2.210			
2 1/8	2.171	2.186	2.215	2.243	2.270	2.296	2.290	2.314	2.337			
2 1/4	2.296	2.31	2.340	2.368	2.395	2.422	2.416	2.441	2.464	2.487		
2 3/8	2.421	2.436	2.465	2.493	2.521	2.548	2.542	2.567	2.591	2.614	2.637	
2 1/2	2.546	2.561	2.590	2.619	2.647	2.673	2.668	2.694	2.718	2.742	2.764	
2 3/4		2.811	2.841	2.869	2.898	2.925	2.920	2.946	2.971	2.995	3.019	
2 7/8		2.936	2.966	2.995	3.023	3.050	3.046	3.072	3.097	3.122	3.146	
3		3.061	3.091	3.120	3.148	3.176	3.171	3.198	3.223	3.248	3.273	
3 1/8			3.216	3.245	3.274	3.301	3.297	3.324	3.350	3.375	3.399	
3 1/4			3.341	3.370	3.398	3.427	3.423	3.449	3.476	3.501	3.525	
3 3/8			3.466	3.495	3.524	3.552	3.548	3.575	3.601	3.627	3.652	
3 1/2			3.591	3.621	3.649	3.677	3.674	3.701	3.727	3.753	3.778	
3 5/8				3.746	3.775	3.803	3.799	3.827	3.853	3.879	3.905	
3 3/4				3.871	3.900	3.928	3.925	3.952	3.979	4.005	4.031	
3 7/8				3.996	4.025	4.053	4.050	4.078	4.104	4.131	4.157	
4				4.121	4.150	4.179	4.176	4.203	4.230	4.257	4.283	

PRESERVE THESE TABLES, AS THEY WILL PROVE A READY REFERENCE WELL WORTH WHILE.

this in various ways, some measuring the depth from the corner of the keyway, others from the center of the shaft, and still others taking a mean dimension between these two points.

The correct way is to machine the keyway slightly deeper than the section projecting above the shaft. The key will then fit on the sides and thus drive more efficiently. If the key fits tightly on the top there is the danger of straining, or even breaking, the hub of the wheel or pulley. The type of key referred to here is the square or rectangular one. One of the tables gives the dimensions for shaft keyways, and the other for hubs of gears, pulleys, etc. The table for shafts gives the sizes of shafts from ⅜ inch to 4 inches, varying by eighths of an inch. If it is desired to find the dimension for a shaft not specified the formulae given at the top will be found very convenient. The radial clearance to insure side fitting is given as .001 to .006 of an inch; this relief we have found to be very satisfactory.

Lathe Work—John Receives Some Pointers

By J. Davies

"WELL, John, are you having any interesting experiences in your lathe work at the shop?"

"Yes, father, I certainly am. The other day I had a gear to bore out a driving fit for a shaft on the foundry crane. I couldn't try it on without taking the gear out of the chuck, and we didn't have any plug and ring to fit the gear and the shaft, so I was left to my own resources. I remembered you had told me 'that a plug and ring gauge would have to fit each other loose to make a tight fit between a shaft and a wheel,' and I knew that all our plug and ring gauges would not pass over each other, so they would have been of no use anyhow. I went after the foreman for a little information on the subject and here is what he told me:

"To be able to correctly turn a shaft the right size for a working or running fit, or bore out a wheel or bush a running fit, or bore out a wheel or bush a running fit with the aid of calipers only, depends entirely upon the skill and judgment of the workman. Generally speaking, the swing of the calipers should be about ¾ in. to the foot.

"The allowance for driving fits depends upon a number of circumstances such as the length of the hole. In a long hole there is more bearing surface than in a short one, consequently the outside diameter of the driven piece can be made a little less. The diameter of the work, the smoothness of the surface, the nature of the metal, and the thickness to resist bursting must all be taken into consideration, so that it is impossible to lay down a definite rule. It is in this class of work that experience counts. Generally speaking, if the hole and the shaft are made exactly the same size up to about six inches you will have a pretty snug driving fit. Always oil the surfaces, as it may happen that the fit is a little too tight and if you want to take it out to ease it a little after you have been driving two dry surfaces together it may give you a lot of trouble.

Allowance For Fits

"The allowance for forced fits is a little more than for driving fits, the main points to take into consideration being the same as those mentioned for driving fits. One firm of engine builders allow for forcing on crank pins one-quarter of a thousandth for every inch in diameter up to eight inches.

"In fitting car wheels and axles it is generally specified that they shall go together with a certain pressure from twenty to thirty tons. Most firms specify exactly the amount to be allowed on their particular class of work. A twenty to thirty ton fit on a wheel and axle requires an allowance of about .008 in.

"In calipering shafts or axles the amount of difference is not always measured, a snap or limit gauge being sometimes used, or the calipers may be set; the insides to the exact size of the hole, and the outsides to the exact size of the insides. Then, by letting the outside drag over the work a fairly accurate estimate can be made of the force required to make the fit according to the length of the drag on the outsides. To find the amount in thousandths of the swing, or drag of a pair of calipers the following rule is often used:

"Let A in Fig. 1 equal side play of calipers or end measuring rod in sixteenths of an inch. B equal dimensions to which calipers are set, or length of measuring rod in inches. C equals difference between diameter of hole and length of B in thousandths of an inch.

Then C equals $\frac{A^2}{2B}$ — within a very small limit.

For example, a standard rod 5½ in. long has ⅜ in. side play, what is the size of the hole?

$$C = \frac{6 \times 6}{11} = 3.27 \text{ thousandths or } .00327 \text{ in.}$$

"This method will be found to be correct within a limit of about .002 inch if the amount of side play is not more than one-eighth of the diameter of the hole. For holes up to six inches in diameter: with 0.0005 in. for holes from six inches up to twelve inches; and within 0.001 in. for holes from 12 inches to 24 inches.

"A shrink fit refers to the method of putting two pieces together, usually by heating the metal around the hole, thereby causing it to expand; then putting the piece that has to be shrunk on to it through the hole, allowing it to cool and contract on the axle, or shaft, or what-

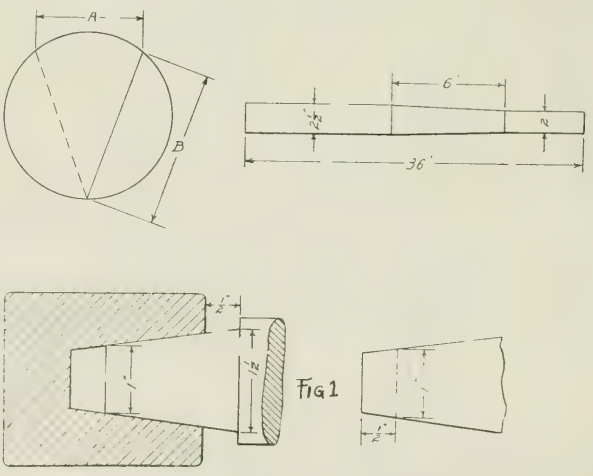


FIG 1

REFER TO TEXT FOR DESCRIPTION OF VIEWS SHOWN.

ever it may be. A good rule is to allow .003 inch for the first inch and 1½ in. thousandths more for every inch up to 20 in. diameter.

"The amount of shrinkage for locomotive tires adopted by the American Railroad Master Mechanics' Association is as follows: 38 hole amount of allowance, .040 in.; 50 hole, .053 in.; 56 hole, .060 in.; 62 hole, .066 in.; 66 hole, .070 in.

"Speaking of good fits reminds me of a story I heard the other day of a machinist who was sent to an outside repair job. The job was turning a new piston for an engine in a small factory. He was sent to the factory to measure up the cylinder, then it was his duty to turn up the piston to fit.

"The piston was duly finished and delivered, but it was found to be impossible to get it into the cylinder. Complaint was made to the shop and the machinist in question was asked to give an account of his workmanship. He asked the engineer who had charge of putting the engine together if he had oiled the cylinder. The engineer replied, 'Yes, I thoroughly cleaned and oiled the cylinder.'

"'Oh,' replied the machinist, 'that accounts for it. That's why the piston wouldn't go into the cylinder. I didn't allow for oil.'

"Of course, that is only a joke, but this actually happened. In a machine shop near Toronto during the war they were making 18 pound shrapnel shells, and when they first started out they used aluminum gauges, that is, aluminum bodies with hardened steel tips. Later on the aluminum bodies were discarded and cast iron used instead. It was found that the cast iron did not spring as much as the aluminum, and one day a shell operator, engaged in turning bodies, came into the tool room with a cast iron gauge in his hand. He threw it on the bench and said he wasn't going to use that thing, as it was no good. The tool maker asked, 'What's the matter with it?'

"'Matter with it,' replied the workman, 'why there is no spring to it; I can't shove it over the job.'

"You see, his trouble was that he had no idea of the sense of touch. If you get the inside and outside micrometers and leave the hole about .002 smaller than the shaft it will be a pretty tight fit."

The next job John had was to turn a shaft partly parallel, and partly taper, and as he had no experience in taper turning he promptly consulted the lathe hand next to him, who happened to be an experienced old veteran. This is what John was told:

Turning Tapers

"There are at least three different ways of turning taper work between the centres of a lathe. Each method has its advantages and disadvantages, while to a great extent the choice of one or the other of the methods depends upon the work in hand. The first method is by setting the tail stock spindle or dead centre out of line with the live centre. There are usually graduations on the back of the tailstock with a zero mark indicating when the lathe is cutting parallel. If there are no graduations, make one with a fine chisel, then the amount that the tailstock is set over can be measured with a scale.

"In order to use this method it is necessary to figure out the amount of taper per ft., or per inch, whichever is the most convenient. Compare this with the length of the job, or else assume that the work is one continuous taper from end to end. Suppose, for example, we had to turn a taper according to sketch shown.

"In this case the taper is ½ in. in six inches, or 1 inch per ft., but the total length of the job is three feet. This means that there would be three inches of taper in the complete piece. In other words we would have to set the tailstock over 1½ inches, which is half the amount, because, when the tool cuts into the work, say ¼ in., it makes the job ½ in. less in diameter. Setting over the tailstock is most convenient when the job is a long one and the taper is slight.

"The objection to setting over the tailstock, however, is this, that the centres are not in line, therefore they wear unequal and uneven, and the part to be tapered is very apt not to run true with the part that is parallel. If a number of pieces of different lengths were to be turned the same taper the lathe would have to be reset for each piece; and even if they were the same length if the centers were not all drilled to the same depth it would make an appreciable difference. Another way in which the lathe may be set for turning tapers is to turn a small portion at one end of the taper to the small size, and another portion at the other end of the taper to the large size. Then run the tool backward and forward between the narrow strips that are turned and adjust the center until the tool exactly touches both ends.

"This method is equally adaptable for setting over the tailstock or the compound rest. Tapers can be turned by hand by swinging round the top slide of the compound rest. This is the best method for short, abrupt tapers, and it would greatly facilitate matters for the lathe hand if draughtsmen would give tapers in degrees and state amount per ft. in addition to giving the dimensions, as the lathe hand could then put his rest round to the degrees indicated on the drawing. A table of tapers and angles will be found useful in connection with lathe work, and these can be found in almost every machinist text book.

"No matter what method is used it is important to set the tool exactly level with the centre, and this can be done quite readily by using the mark on the tailstock. If the tool is set on the centre of the work and a cut taken, then the tool removed and not put back at the same height, the taper of the work will be altered. Should we put the tool either too high or too low it will take too much off the large end.

"This fact can sometimes be used to advantage. The work in hand might be slightly big at the large end, so, instead of moving the taper attachment, merely raise the tool a little.

"After roughing a tapered piece it should be tried in the place it is intended to fix, taking care to leave it sufficiently above the size to allow for fitting. If one end is much too small it can be detected by rocking the work in the hole. After fitting till there is no perceptible play in the hole, give it a turn round by hand. The marks will be rubbed off the high spots and the taper should be adjusted until these marks show a full bearing along the surface of the taper. After fitting satisfactorily, measure how much further the taper needs to go into the hole to be in its correct place. Suppose Fig. 1 is fitted correctly, but requires to go in ½ in. further to be in its correct place. Measure with calipers very carefully the diameter of the taper at the small end of the shaft, then take a fine cut and test with the calipers until the work is the same size as the calipers ½ in. from the end. By this means, after getting the taper a good fit, you can make it the correct size at the next trial. It is better to err a little on the full size, as you can then give it a rub or two with a file, but if too small there is no remedy."

PALM OIL AS A FUEL

The world's supply of mineral oil is limited. At least, so say geologists, so that the experiments with vegetable oil as a motor fuel should be of decided interest. The oil used in these experiments has been palm oil, well known in the commercial markets as one of the most desirable ingredients of the nut-margarines. The tests have been carried on in Brussels, with a view of making use of palm oil, if practicable, as a motor fuel in the Kongo. The difficulty of transporting mineral oil to the Kongo, and its high cost when delivered —about $1.40 per gallon—made the finding of a substitute a great desideratum. And, as palm oil was one of the products of the Kongo, and could be had there for about 20 cents a gallon, the reward for its successful adaptation was alluring.

The calorific value of palm oil varies from 75 to 80 per cent. of that of mineral oil; therefore, from one-fourth to one-third more must be burned to get the same power.

The experiments have proved that palm oil will work perfectly in a certain form of motor of a semi-Diesel type without any change, in the ordinary Kongo temperatures. In Belgium, how-

ever, where the winter temperatures are below the solidifying point of palm oil, an accessory is necessary to liquefy the oil. Further, in Belgian winter temperatures it has been advisable to start the motor with petroleum, and when it is well warmed up to substitute the palm oil.

The experiments have shown that palm oil burns completely, leaving no residue. So far the trials have been made chiefly on motor boats, but they are being extended to tractors and industrial motors. In July, 1920, the Belgian Ministry of Colonies initiated a prize contest for tractors operated on any of the vegetable oils produced in the Kongo. Only one contestant appeared—an evidence of the lack of research along this line.

With the passing of petroleum, an eventuality already being discounted by the geologists, the practically unlimited production of vegetable motor oils may easily become one of the important industries of the near future.

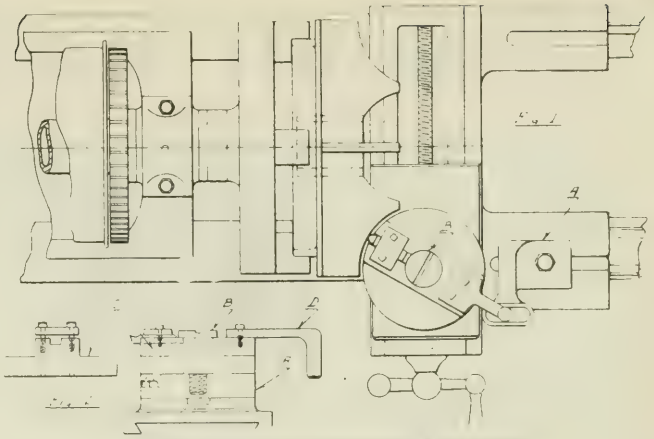
RADIUS TURNING ATTACHMENT

By G. Barrett

The accompanying sketch illustrates a radius turning attachment for use on a lathe, and may be adapted for a wide range of work. Fig. 1 shows a plain view of the device, set up to turn the radius on an impeller, this operation requiring considerable accuracy to provide the suction required. The attachment consists of a swivel casting A, Fig. 2, turned to fit the lower portion of the cross slide of the lathe. This casting is secured by bolts in the usual manner, and the top surface carries a revolving tool block C, held in position by the central bolt B. The link D is securely fastened to the upper face of the tool block, a tongue being provided to prevent shifting. The pin portion of the link D fits into the elongated slot in the bracket A, which is bolted to the carriage of the lathe.

When the cutting tool is set, and the link and bracket in position, the movement of the cross slide will cause the tool block to revolve and the tool point will cut the desired radius on the work. It should be mentioned that the tool point should be set at the horizontal lathe centre, otherwise the result will not be a true radius. This attachment has the advantage of being self-contained, and once set will produce uniform work without the use of a cam, weight or springs, and is very simple to operate.

More than 5,000 men employed by the Canadian Pacific Railway will be taking a compulsory holiday from March 23 to April 4, owing to the closing down of the Angus shops in Montreal. This is being done because the work has been caught up, thus affording a method of reducing expenses.



DETAILS OF THE RADIUS TURNING ATTACHMENT

LEAD AND SHEET IRON

A reinforcement of lead with perforated iron sheet has been found to increase the elastic limit four to five-fold, and the tensile strength from two to three-fold, the variations being due to differences in gauge of wire and mesh used. Lateral extensions of 20 per cent. and elongation of 20 per cent. have been obtained. Sheets 4 ft. 6 in. by 5 ft. 6in. have been made. These reinforced sheets may be bent or shaped almost at will, as the lead does not fracture when bent. The sheets may be cut and joints burned together as in ordinary sheet lead. A pipe, 8 inches in diameter, made up of reinforced lead 0.2 inches thick, when tested for strength, collapsed under a pressure of 85 lbs. per square inch.

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Stocks Are Running Low

BUYERS may wake up some day to find out they have stayed out of the market too long.

When people cease to buy, or when they cut their purchases to the bone, and then trim the bones down, they must know that manufacturers are going to ease off in their schedule of production. It is poor business to stack up great heaps of material against the day when the buyers may flock back again to the markets.

The buyers of steel and iron have been taking on just as little as they could stand. For some time this has been true all through, including warehouses and manufacturing interests. They have thought of hardly any other thing except liquidation of stock.

The result is that stocks are getting low, in some lines so low that certain yards are out and have to send their orders direct to the mills.

There is every prospect of a railway strike in the United States. The one last year is still fresh in the minds of the people. There were Canadian industrial concerns spending thousands of dollars in order to get supplies of raw and semi-finished material through.

Is it not worth considering what will happen if there is another strike, with stocks getting well thinned out in many lines in Canada? How long, under such circumstances, would prices remain at present levels?

Making Use of The Time

GOING through a period such as the present, it is very easy for a salesman to sit back and wait for things to turn better. He has not closed much business, and perhaps believes that when the corner is turned things are going to come better.

Here is another way—not imaginary, but real. It is the experience of a practical man who knows how to sell machine tools on their merits, and who understands the various operations that his machine tools are put in to perform.

He finds that right now is a splendid time to do effective missionary work for his firm. The superintendent in most cases is not very busy. It is possible also to get to the executives higher up for the same reason. Were things humming around the plant he could not get as much time from the prospects to lay his proposals before them. There are many fine points that would never be brought out, and many prejudices that would be allowed to ride because there had been no opportunity to meet them and correct them.

It works both ways. The average superintendent or purchasing agent is anxious to be well informed. If a salesman goes to him prepared to impart real information on any given subject of interest, he is going to give him a hearing.

The plant executive, if he is a real one, will be open to suggestions concerning the improving of any operation carried on in his plant. He should count it a good day's work in this rather dull season if he can bring out one good idea that will make for better and more efficient production methods when operations start at full blast again.

Standardization Up Again

STANDARDIZING farm implements was brought up in the Dominion House a few days ago. Those who urge this might be well advised to go to some good shop superintendent, or designer, and talk the whole thing over. Once they were possessed of all the facts they would see where their very good intentions were quite impracticable and equally undesirable.

Speaking of this move, George Wedlake, manager of the Cockshutt Plow Co., states that "nothing could be gained by it, as it is not practical. It has been brought before implement manufacturers at other times, and it has been decided that there was nothing for the customer to gain by it." Mr. Wedlake also believes that beyond the standardizing of nuts and bolts and the use of standard plows, no more progress can be made.

Implement makers do not change designs simply for the sake of piling up various designs. They do not change patterns unless they see a very decided advantage, for every change in design means added expense, and the only chance to recover is in the selling power coming from the added quality put into the machine.

Standardization is not desirable from another point of view. It smells musty and smacks of smug contentment with present accomplishments.

If implement makers had standardized on the old reaper we would not to-day have the self-binder.

If we had standardized on coal oil lamps we would not be using electricity.

If we had standardized on certain faces of type and a Washington press, we would not have our linotype and rotary presses of to-day.

If the navigators of old had standardized on certain types of sailing vessels, we would not to-day be crossing the Atlantic in a day or so under a week.

Standardization is not going to solve the problem of the use of our own iron ores. It is going to be done by research, by persistent hard work, by reaching out after things we have not yet attained, but never by thinking that what we have is the last word in design and practice and therefore not open to improvement or alteration.

This question apparently has to have its little fling in the Dominion House every year. It is just another case of a member of the House trying to make himself strong with his constituents by talking about matters on which his technical knowledge is limited.

Shall Canada Trade With Germany?

ON WHAT grounds shall Canadian firms go ahead and re-establish trading conditions with Germany?

Canadian Machinery readers are evidently very much interested in this matter, knowing as they do that each week sees more evidence of the coming of the German-made article. Their catalogues also are coming in increasing numbers, and although there may be a disposition at first hand to drop them over into the waste-paper basket, many of them are being read and studied.

Not After German Business

P. Ford-Smith, president and general manager of the Ford-Smith Machine Co., Hamilton, cannot bring himself to welcome German trade with open arms. The war days and the memories of German war methods have not been blotted out as far as he is concerned. Mr. Ford-Smith says:

"We appreciate that if the Allies are to collect a huge war indemnity from Germany they will have to be allowed to do business. However, as far as this firm is concerned we will not trade with Germany, either by buying or selling to that country. It is probably nearly a year ago now that we were offered German small tools and machine tools, and we wrote to the firm, replying to their letter, and told them that we would not consider any business relations whatever with them, that we had no desire to meet or to deal with any German people. As a matter of fact, we told them to go to h—.

"I do not say that this should be the attitude for everybody to adopt, because no doubt there are certain things that Germany can make that we cannot make, and that she may have a genius for, and it would be ridiculous not to take advantage of this. But in the main, where goods can be purchased either in Canada first, or afterwards in any of the Allied countries, that is where the business ought to go.

"There is a great tendency to forget nowadays German atrocities in the war, and there is also a tendency to forget how Germany would have treated us, if we had lost the war. True to form, she is now whining like the cowardly bully she has proved herself to be, and we want to take anything that we are told about the desperate condition Germany is in, and how she must have business with the Allies, or go absolutely under, with a grain of salt, in fact, quite a large portion of salt. We also want to remember in regard to this helping her on her feet again, that if she ever gets in a position to turn the tables on France or Great Britain, she will do it, as she has declared.

"If it had been any other country than Germany, we could look at this matter in a different light, and I think that Canadian buyers in all lines should make it a principle not to buy German goods except where they cannot possibly get them from anybody else."

Policy Not Decided on Yet

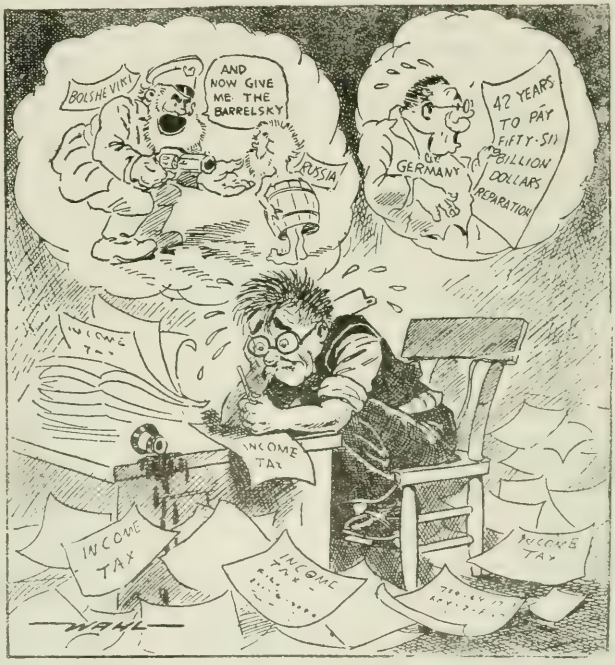
Butterfield & Co., of Rock Island, Quebec, have not reopened trading with Germany since the war, the exchange, of course, making it almost impossible to sell anything to that country. F. S. Laythe, assistant treasurer of the company, answering a question from this paper on the point, says:

"We are in receipt of your favor of the 8th, asking us what our position is with reference to trading with Germany. Up to the present time we have given this matter very little conssideration, as we have not been approached by German interests either to buy or sell.

"We never made any purchases in Germany, but for about 15 years previous to the war we had an agency in Germany, and while we never made large shipments, we had a nice little trade and our business connection with our agent were entirely satisfactory. Of course, when the war broke out this connection was broken and, naturally, we have done nothing with them since.

"Under the present conditions of exchange, naturally, we are not in a position to do anything with them now. What the future will bring forth, we do not know, and we are not prepared to say at this time what action we would take in the event that the opportunity of again resuming business relations with them should come up."

CAN'T GERMANY PAY?



—Wahl in "Sacramento Bee."

Two Sides to the Question

There are a good many manufacturers who are caught between sentiment and commercial necessity in this matter. They are not keen to open up accounts with Germany again for sentimental reasons, but over against that they consider the impossibility of trying to isolate Germany from the rest of the world and at the same time collect a large amount of money from her.

G. C. McAvity, of T. McAvity & Sons, Ltd., St. John, N.B., brings this point out in his letter:

"This particular question seems to be very prominent in all parts of the world, and there appear to be a great many different opinions regarding the outcome of same.

"It seems to me that if Germany is to pay its indemnity to the allied nations, that it is going to be necessary to trade with her in order for her to get the necessary money to make this payment. Again, on the other hand, a great many people look at this from a sentimental point of view, while others look at it from the different phase of business only. It is a pretty well recognized fact that Germany, with her low-wage scale, long hours and other manufacturing conditions, is in a position to manufacture much cheaper than we in Canada are able to do, and with the great discount on German money still in their favor, how are the Canadian manufacturers going to live if German goods are to come into this country, and be purchased? Still, if we do not buy their goods, how are they going to pay their indemnity?

"From the sentimental point of view, I, personally, do not wish to see a German article. For the other reasons, as outlined, I feel that we must buy from them. However, I am very interested to learn the different expressions of opinion from other sources."

Here is a manufacturer from Brantford who goes into some pretty sound facts regarding the turning of German goods loose on the markets of Canada. Looking at it in a broad, general way, he says:

"Personally the writer does not for a moment see how it is possible to expect payment of the German debt to the Allies unless trade intercourse is continued. Germany can never pay unless she is traded with, and I believe that all the nations should do all possible so as to enable the Germans to pay to the limit, and then take the money away from them, but Germany should be very carefully watched and her business transactions thoroughly inspected, so that any competition which comes into any line of business is a competition by fair means only.

"This has not been true in the past, and the German Government have subsidized many industries and the industries itself have sold goods at an absolute loss, and have received their profit as a bounty from the German Government. This, of course, is not fair competition.

"Again, there is the question that there are certain commodities which Germany can produce for the benefit of the world cheaper than it is possible for any other country to produce the same commodity, and she should be allowed to produce these goods and sell them, and she should also be allowed to buy from Canada or any other country such goods as these countries can produce and deliver cheaper than she can produce them.

"This letter is not written because the writer has any love for the Germans, and is written largely from the idea of benefit to the opposite side of the question, and in our own interests here in Canada."

Requires Careful Study

That we should regard Canada first in our dealing with Germany or any other country is the contention of one of the largest firms manufacturing in the iron and steel lines. A scientific study of tariff conditions should be made, and there should be a determination to get away from any hit-and-miss policy in framing our future trading relations with Germany. Protection for the consumer is also urged.

This firm's views follow: "If Germany is to be expected to pay the war indemnity, Canada, along with the other allies, must forget to a certain extent their antipathy to trading with Germany, and must be prepared to do business with them, the same as with any other foreign country. From Canada's point of view, it would seem to me that our general policy should be to invite Germany and other foreign countries to compete in Canada for the sale of goods which we cannot manufacture at all, or cannot manufacture to advantage, and that the imports into Canada, whether from Germany or elsewhere, of goods which we can and do manufacture in Canada should be discouraged. In other words, in order to build up our country we should not buy from Germany or any other country anything that we can manufacture ourselves.

"You will perhaps remember that some time before the war a commission from Canada made a tour of Germany to study manufacturing conditions, and Government policies in Germany in connection with the building up of their export trade. At the present time we cannot recall the names of the gentlemen who composed that commission, but I believe that G. M. Murray, of Toronto, who was with the Canadian Manufacturers' Association at that time, accompanied the commission, and could, we think, give you some very valuable pointers on what the commission saw and heard in Germany.

"At the present time, when our fiscal policy seems to be paramount in everybody's mind, it would be timely to consider what Germany did in building up her industries and export trade, and instead of the haphazard kind of tariff which applies at present, we should have a scientific revision of our tariff by means of a capable tariff board, which would provide the necessary protection for growing industries, as well as protection for the consumers, and make it possible for us to do business in lines in which we ought to do business with Germany, and eliminate ruinous competition with her in lines which we can manufacture ourselves to market at reasonable prices.

"We cannot afford to treat the matter of trade with Germany sentimentally, if we expect Germany to meet her obligations, and we must be prepared to do business with her on a fair and equitable basis for such goods of her manufacture as we will require."

The Use of Ball Bearings

When thinking about the installation of ball bearings, it does not pay to do **too much thinking.** After you have decided to use such bearings, do not puzzle over how you shall apply them. Leave that to those who have made a life study of the subject.

Many cases are existent at the present time where ball bearings are applied, yet not delivering 100 per cent. service. The proper application of ball bearings is a special study. There are numerous factors entering into the problem—for example, the danger of dust and dirt. This is only one of many, so why not leave the actual planning to someone who knows.

Many machine tool designers may consider this a reflection on their ability, but such is not the intention. Unless they have had practical experience in this line of work, consultation should be held with some reputable concern making such bearings as they **think** they require. We say think because in many cases the bearing they believe ideal for the purpose is not the correct type to use at all. As service of this nature is free, why not take the benefit of it?

Here is a typical case of what actually happened a short time ago. A certain manufacturer called up a ball bearing company on the phone, and this conversation ensued:

"I'm developing a new machine, and I want some advice regarding ball bearings. Will you come up right away?"

"I'll be out there within an hour," was the reply.

Soon the chief designer, the manufacturer and the ball bearing expert were delving into the problem, with the result that everybody was satisfied. The manufacturer knew he had secured the best of advice, the designer had learned something fresh, while the expert had stated what in his opinion would suit the machine. Even the ultimate user of the machine got better value for his money, for he received the benefit of an ideal installation.

MARKET DEVELOPMENTS

Slight Improvement Noticed in Markets

Pittsburgh Says The Demand for Steel is a Little Better, While in New York Tools Are Being Inquired For—Toronto Business Shows Small Improvement in Some Lines

THE general tone of business in the machine tool, steel and iron markets is slightly better this week. This does not mean that any great amount of bookings are being made, but it does mean that more orders are being received by several lines, and that in others inquiries of a perfectly reliable sort are being received.

In a good many lines it is still true that prices are not allowed to stand in the way of orders not being placed. Small tools and some lines in the steel warehouses are going out under these circumstances. Here is a peculiar situation, though, which is developing. Warehouses have not been buying for some time. They have been busy liquidating the stock they had in hand, depending on the mills to give them quick delivery on lines they were running short of. During the past week it has developed that some warehouses have lines in demand, while others have not, with the result that there is no more losing liquidation on the part of the firms that have the wanted lines. They are able to sell at a profit.

Nothing definite is heard in regard to prices in the steel market coming down any farther. The Corporation schedule still stands, and its selling agencies in Canada are working on that basis, but the independents are coming pretty well under the market. It is doubtful, though, if much real tonnage has been brought into the market by any of the price slashing that has taken place.

The scrap metal market does not improve. Any movement at all would probably be for the better, for dealers feel that it has about run its limit as far as low prices are concerned. Some of the railroads and industrials in United States continue to offer their sortings at lower prices, preferring to turn them into cash. The result is that, although prices are very low, there is no guarantee that they have yet touched bottom.

MONTREAL LOOKING FORWARD TO THE OPENING UP OF NAVIGATION

Special to CANADIAN MACHINERY.

MONTREAL, March 24.—The continued mild weather, accompanied by wind and rain, has served a good purpose in the way of clearing the ice from the River St. Lawrence, and it looks as if it is only a question of a few days before the harbor will be open. Officials anticipate the first of April at the latest. What effect the opening of navigation will have upon business in this district is, as yet, uncertain, but, in former years, it has always aided in relieving the tension that has been more or less marked at an ocean port during the closed season. The opening of Montreal port has always created a spirit of enthusiasm amongst merchants and should do likewise this year; in fact, some state that business will improve with the commencement of navigation. While some of the railroad shops here are contemplating further curtailment or shut downs for short periods, there is increased activity in other directions. The Dominion Engineering Company across the river are commencing operations and other engineering firms are reporting steady activity, but seldom of a brisk character. Manufacturers, as well as dealers, are apparently waiting for something to break.

No Demand For Steel

"It would be going beyond the bounds of good judgment to say that a change for the better has taken place, but our business for the past week has been larger than for some weeks back. Of course, we may be faced with lesser business this week, which would counteract last week's good sales. However, we have been cheered up a little, and even though the betterment is of a passing nature, the thought alone keeps us optimistic." This statement by a steel merchant here might imply that conditions are improving, but when one takes into consideration the poor business that has been going, any improvement over previous weeks, unless it be of a considerable character, would give little encouragement to the average merchant. When asked as to the probable duration of present depression, this dealer was reluctant to make a statement, as he said he had hoped, earlier in the year, to see things picking up before this date, and that here we were with the prospects almost as obscure, if not more so, than at the beginning of the year. The conservative attitude that dominates all phases of the steel business is very pronounced. Consumers buy in small lots for present requirements, and dealers carry as light a warehouse stock as is consistent with the needs of the trade. The general report from dealers is that there is "little doing." As stated in one instance: "We are just sitting here waiting—how long this wait will be we cannot tell, as the slight fluctuation in demand shows no signs of steady improvement; it is up a little today and down again tomorrow."

Supplies Selling Best

Little more can be said of the machine tool trade than that many of the dealers are carrying on, seemingly content to keep things going during this period of pronounced depression. The sale of equipment now is a hard proposition, and it is a clear case of need when the manufacturer buys machinery or material. Although the sale of equipment is proportionately light the keen competition amongst salesmen to get business of any kind, makes it possible for users to get their needs supplied at surprisingly low figures, particularly if they can afford to take the time to get the varied quotations from the different dealers. An inquiry

that does not net business makes the dealer feel that some other fellow has under-quoted him, and the possibility is that the next inquiry will result in a lower price. This cannot be done in all cases, but on many lines this attitude is followed in getting business. The market on the surface seems quite clear but closer contact, when actually buying, indicates the presence of air holes into which the customer is drawn by the current of the trade. The "heavy" business at present is being done in the lighter supplies.

Prospects Little Brighter

The light movement of old material continues to keep the market in a depressive mood. The demand for scrap of all kinds is practically nil, and it is generally only regular customers that are buying at the present time, and then in such small volume that other than passive interest is not aroused. The situation just now is not one that is controlled by price, as quotations are little guide to actual sales figures. "Supplies we have on hand just now," said a dealer, "were acquired at prices higher than are now quoted, and we are endeavoring to dispose of much of this before we take on any more material. This, however, is subject to trade requirements and with buyers virtually out of the market, it looks as if it would be some time before we can expect a stable condition." There is not the same hopeful spirit that there was a couple of months ago, and instead of looking for a betterment in the early spring, the general opinion seems to indicate an extended period of existing dullness. Prices are unchanged but the trend is weaker.

BETTER REPORTS ABOUT BUSINESS

Firms Have Reason to Believe That Corner Has Been Turned Toward Better Days

TORONTO.—No one seems prepared to stand up yet and admit that he is getting any more business than he can conveniently handle with his present staff, but there are a number of firms quite willing to admit that they can see an improvement in business, and that last week was by far the best one this year.

Inquiries continue to come into the market, and although they do not represent a great deal in the way of closed business, they are accepted as good working material by the firms interested.

Collections continue to be fairly slow in some lines, while other firms report that they are having very little trouble with this matter, apparently indicating that firms that make collecting a real job are finding now that their well-organized department is coming in very handy, and making financing much easier for them than would otherwise be the case.

The Machine-Tool Market

Machine-tool dealers are closing a fair amount of business, most of it pretty well scattered, and in the shape of additions to existing plants, rather than new installations.

One dealer, who has covered quite a wide range of territory during the past few weeks, reports that while he did not close much actual business he is more than ever satisfied that the corner has been turned, and we are on the way back to better days.

Business in the East, he claims, is slow, there being little to accelerate buying there. In much of the country it all depends on the steel and coal business, and in the former there is little activity just now. Around Halifax things were quiet, too, and with the exception of a couple of Government ships in the yards there, there was nothing in the ship yards but repair work.

Railroads Not Buying

There was some expectation, apparently not very well founded, that the railroads would be doing a lot of buying about this time of year. One of the officials, discussing this matter just a few days ago, explained that it was not likely that extensive buying would be done now, although some of the shops were in need of equipment. The weather had been very kind to transportation during the winter months. The absence of snow had made it an easy matter to keep the rolling stock in very good shape, and so there was no call for additional machine tools now. Then there are the Government roads, this same dealer went on. If a private concern were as hopelessly in debt as these roads are we would not look upon them as very good prospects for placing equipment. It may be that a great deal of reorganization is necessary in the case of the latter, he continued, and this reorganization might find it very advantageous to have much better equipment than many of the Government shops boast at the present time.

Prices of Tools

Old country machine tools have stayed up pretty well in price, but there are indications of a change in this attitude, and the buyer can sit in now and talk price to them and they are disposed to listen. Machine tools are not moving out very rapidly in England now, and in some cases the larger makers have accumulated quite a supply, something that is rather unusual in their history. In quotations that have been made in several pieces of special equipment recently prices put in by British firms are lower than those submitted by the makers in other countries.

The Steel Market

"There were days last week when it seemed almost like dipping in on the

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports that the Steel Corporation during the past week has not been operating much more than fifty per cent. capacity.

—

The price for pig iron in some of the U. S. districts shows a tendency to go even lower, although $25 is still recognized as the bottom figure.

—

There has been a fair demand for sheets during the week in Toronto warehouses, industries connected with the pulp and paper business and with some of the northern mines doing the buying.

—

According to advices there may be a drop in the price of some British machine tools before very long.

—

Boiler tubes are being sold in fair quantities, the bulk of the sales apparently being for the smaller sizes.

—

Bar mill material, especially for reinforcing purposes, is not selling as freely as it should be at this time of the year. Slowness in getting building operations under way is responsible for this.

—

Several large makers of machine tools in United States have sent out notices of reductions in their selling prices, generally running from ten to fifteen per cent.

—

The past season has been a very light one on railroad upkeep work, and for that reason the shops have not found it necessary to purchase the amount of equipment expected.

—

Small tools are being sold in very small lots, and some of the dealers are complaining that prices are being cut to secure the little business that is offered. According to some reports business is being done at as low as five per cent. profit.

—

The directors of the Dominion Steel Corporation and the Nova Scotia Steel and Coal Company met at Montreal on March 21st to discuss the proposed amalgamation of the two companies with the Halifax Shipyards in the British Empire Steel Corporation. After the meeting it was announced that both boards had approved of the contracts covering the consolidation and that special meetings of both the Steel Corporation and Scotia common shareholders would be called for April 7th next

1920 business again," stated one of the steel merchants this week. "We are not interpreting this as meaning that things have turned all at once for the better, but there can be no denying the fact that we find a gradual improvement."

Sheets were good last week, and still are, and a fair tonnage has moved out. Black (28) gauge is quoted at 6.50, while blue annealed is sold at 6c. A variety of interests contributed to the business that came in during the week. Warehouses are not taking on very much material now, in fact some of them prefer to turn their orders direct to the mills, and for this district very direct motor delivery service is being made from Hamilton. This lets the warehouse out of loading up with a very heavy stock, and it must also have the effect of holding quite a lot of trade in Canada that would otherwise go over the border.

Some Lines Are Short

The warehousing situation is getting to an interesting stage just now. The buying that is being done by the merchants is small, and can more correctly be referred to as releasing material rather than purchasing it. In some lines where there has been a decided effort toward liquidation, stocks are getting fairly low, with the result that business has to be directed to the places carrying these lines, if quick shipment is desired. The result is that merchants having well-assorted stocks are able again to get their price without having to slash away at a rate where no money was made. Of course this is not a general condition, but it has taken place, and is taking place. Warehouses are not minded yet to do much buying, claiming that they can get very prompt mill delivery, and that mills are encouraging them to send in much smaller amounts than formerly.

The Sale of Tubes

Tubular goods are moving out fairly well, and in this the small sizes are perhaps leading, tending to show that small industrial concerns are overhauling their plants while in the case of the larger power plants things are being passed up for the season as far as repairs are concerned.

There is a fair demand for reinforcing material, although the demand is hardly indicative of a very active season's work in the building trades. Industries that have work from the pulp and paper mills are buying a fair amount, while some of the mines are also taking on a few carloads. There is perhaps nothing unusual about any of this business, as in ordinary times the buying would be still larger, but any kind of business is welcome in the market under present circumstances.

There have been some disputes over shipments sent in here from some of the United States mills, and a number of cars have been sent back.

Small Tools Are Slow

Small tools are moving slowly, and firms requiring these are buying what they need for right now. "In fact, you would think they were all going to close to-morrow by the way they are buying to-day," remarked one dealer who was complaining of the smallness of the orders, particularly during the present month.

One also hears a good many reports of price cutting that is being done in the small tool market. "They all get together, and decide to play the game square and sell on the quality of goods and ability to make deliveries by the consumer, and all goes well for a short time. But once things get scarce, believe me the prices begin to fly. I am certain there are jobbers right in this district now that are doing business on a 5 per cent. basis. Ten per cent. is the proper basis, and it is not possible to operate below that, especially when the volume of trade going is smaller than usual."

PITTSBURGH REPORTS A BETTER TONE IN THE MARKET WITH SOME ORDERS

Special to CANADIAN MACHINERY.

PITTSBURGH, March 24.—There has been a further increase in the volume of steel business over that noted in last report, and in addition a little inquiry has appeared from steel works for basic pig iron. The beginning of improvement is very modest, but there is at least a beginning. It requires close scrutiny to discern any change, but business has been so bad that everyone is willing to make the effort necessary to see even a small improvement.

The improvement does not mark the beginning of a spring buying movement according to those who analyze the orders that come in. The buying is the beginning of a reaction from the extreme stagnation of the past few weeks, a stagnation that could not continue indefinitely, for the buying was far below the amount needed to keep operations going even on the limited scale that characterizes a period of hard times. That is, after every period of great activity there is a special period of stagnation during which time old orders are worked out and stocks are consumed. Then, if ultimate consumption does not increase, there must nevertheless be hand-to-mouth buying, and that is what is now starting.

A spring buying movement is to be expected, but it is not discerned yet. When it comes it will simply add to the activity, and it is certain to come very shortly. For the general and widespread improvement, from the long range viewpoint, one must still wait. That is in the uncertain future.

Production and Demand

While production of pig iron and steel products has been constantly declining, it has been far above the quantity of expressed demand. The latter is increasing, but for the two to meet the one must decline further and the other increase. The meeting will now occur in a very few weeks.

The independent steel interests are not operating any better than a few weeks ago, and indeed hardly as well. Previous records have indicated that the independents as a whole ran at nearer 30 per cent. than 25 per cent. in January and at nearer 25 per cent. than 30 per cent. in February. For the present rate, some estimates are 25 per cent. but others only accord the independents 15 or 20 per cent.

The Steel Corporation's operations have decreased more sharply in the past week than in former weeks, the Corporation's highest production having been in December and up to the middle of January, whereas the independents had already reached a point of curtailing operations. Generally speaking, it may be said that the Steel Corporation's declining operations have come just above four months later than was the case with the independents, this being the sequel to the Steel Corporation's holding its prices down late in 1919 and in 1920 while all the independents advanced their prices.

The Carnegie Steel Company, which was the highest operating subsidiary of the Corporation outside of the National Tube Company, has had the greatest decline. In the past week or ten days the Carnegie Steel Company has made a new record, by blowing out 13 blast furnaces in that short period, reducing the active number from 38 to 25. The company's high point was 48 furnaces active, for a time last January. Last week's ingot production by the Carnegie Company was about 45 per cent. of actual capacity, against about 60 per cent. the previous week. The ingot production by the Steel Corporation as a whole was about 45 per cent. last week against about 55 per cent. the previous week.

Prices

Except in sheets there has been no noticeable decline in the past week in steel prices done by independents. The Steel Corporation continues to maintain its prices and shows no signs of contemplating any reduction in the very near future. While it may not be clear to outsiders who have publicly suggested that the Steel Corporation ought to reduce its prices, it is plain to those in the trade that there would be no stimulus given to business by such action. The Steel Corporation's customers as a body do not desire that the Corporation reduce its prices at this time, and indeed not a few of them have placed them-

selves on record as fully approving the Steel Corporation's policy of price maintenance. It is a plain matter of business. These customers have stocks of steel or of finished wares or both, which they want to dispose of to the best advantage, and a reduction in the official steel prices would simply depreciate the value of this material. If the customers wanted to buy large quantities of steel the case would be different, but they do not.

Sheets can now be done in carload lots at 3.85¢ for black, when a week ago it required a larger order to bring out a price under 4c. Galvanized sheets are easy at 5c for carloads, with possibilities of shading this on larger lots. Blue annealed sheets are quite neglected, 3c. being commonly regarded as the market, but possibly a buyer with a fair-sized order might develop something less. The heavy gauges can, of course, be bought for considerably less, on the plate mill schedule.

Bars remain quotable at 2c and shapes and plates at 2.10c. These prices can now be done on single carloads, if the specifications are satisfactory, and that may represent a slight easing off, since a fortnight ago one would probably have to offer more than a carload to get such quotations. The minimum done on plates seems to be 1.90c, this being on a very attractive order.

Pig Iron

Inquiry for basic pig iron is small but it is easily the best seen for many weeks, there being live inquiry for 3,000 tons from a consumer west of Pittsburgh and inquiries for 1,000 tons each from a steel interest in the Shenango valley and a steel works in the Allegheny valley. The tone of the market is a shade better. The merchant furnaces will not budge a cent on these inquiries from their regular quotation of $25, valley. It looks now as though the steel works that had accumulated some iron by not slowing down their blast furnace operations as rapidly as they did their steel works will not dump the iron accumulated on the market but will keep it for their own use. There remain the brokers, who have some iron, and who will probably get the orders now going by shading $25, but the merchant furnaces feel that the iron will have to be gotten out of the situation some time and now is the best time.

Bessemer iron remains quotable at $27, valley, and foundry at $26, with no inquiry worth mentioning.

The offical report of pig iron production in 1920 has just been made, the total being 39,925,987 gross tons, against 31,015,364 tons in 1919 and the record of 39,434,797 tons in 1916. Capacity is about 45,000,000 tons, while production in the past week or so has crossed under the 20,000,000-ton line.

FEW MORE CUTS IN N. Y. MARKET

Railroads Are Not Buying Until the Talk of Strike Has Been Settled

Special to CANADIAN MACHINERY.

NEW YORK, March 24.—There is a little more life in the machine-tool trade, but it is confined mostly to inquiries. Actual orders in some lines, notably milling, grinding machines and punches and shears, are being placed somewhat more freely, but there is still much to be desired even in these lines.

The tendency of prices continues downward. A leading manufacturer of lathes and milling machines has reduced prices on milling machines about 15 per cent. and is expected to announce a 10 per cent. reduction on lathes also. Some other lathe manufacturers have made reductions.

The most important inquiry of the past week was from the General Electric Co., Schenectady, N.Y., for about thirty machines. When the slump in machine-tool buying occurred last fall, the General Electric Co. stayed in the market for a considerable time, but finally stopped all buying before taking final action on several fairly large lists it had issued for its various plants. The inquiry received here last week is the first indication that this non-buying policy has been changed. No orders have been placed yet by the American Sugar Refining Co., New York, or the Batavia Car Works, Batavia, N.Y., whose inquiries were reported a week ago, but it is expected that the business will be placed soon.

The trade lacks snap, but the improvement in inquiry has created a better tone among sellers in some lines, while in other lines things remain as dull as they have been at any time during the past few months.

Except for more prospective buying by the Japanese Government and an inquiry from a Porto Rican sugar company there is scarcely a sign of life in the export machine-tool trade.

The railroads have a number of small inquiries out, but it is doubted that orders will be placed until the present controversy between the roads and their employees over the wage question has been settled.

KEEPING UP THE GOOD WORK

It is said that rapid progress is being made with the special process of electric welding which was successfully employed by the British Admiralty during the war in the construction of a "rivetless"' 1,000-ton steel barge for transport purposes.

The peculiarity of this process is the use of special electrodes covered with flux, which prevents the oxidation of the welding metal. Further, by using electrodes and fluxes of special composition steel of any particular character —mild steel, nickel steel, high-tensile steel, vanadium steel, and so on—can be deposited direct. Cast-iron of good quality can also be obtained by this system of welding. Extensive repairs are being carried out in worn tramway tracks, cracked omnibus wheels, and old motor car shafts, and a company has been formed for the production of welded motor car wheels. An important feature is that only a moderate amount of skill on the part of the operator is required to secure satisfactory results.

DOES THE PRICE DETERMINE SALE?

One Dealer Passes Along Some Observations Made in Recent Days

Is this a price market for machine tools and similar articles, rather than a place where quality is highly considered?

The question is prompted because one of the dealers in Canada believes that price is one of the great factors on determining sales here now. His belief seems to have been strengthened lately by coming in contact with another salesman who was out selling a high-grade article, the chief competition to which came from a much cheaper make.

The last-named man was out selling a high-grade magneto, but he found that he could not sell against some of the makes that seemed to have the run of the market at a lower price. There is no question that the article of the high price is a superior one, but it can't be sold in the present competitive market.

One of his customers, a maker of tractors, told him, "We have to make things with regard to price. We put the most quality we can in, and try to turn out something that will stand up and give the purchaser his money's worth, but we have got to cut out the high quality in order to get down to the price at which the thing will sell." The salesman handling the magneto has written his firm asking for a re-design that will bring the article down to the price the people here want to pay. If they will agree to this proposition he seems to think there is a big field in which to do business, but if they insist on keeping up to a price they might as well leave the market.

We are not making any comment on this, simply passing it along as one of the opinions of the Canadian market that one hears in the course of a day spent around the warehouses and supply stores.

MONTREAL NOTES

E. T. Spidy, who for the past several years has been production engineer at the Angus shops of the C.P.R., has severed his connection with the railroad company to become associated with the Dominion Engineering Company, being appointed to the position of assistant superintendent. On the occasion of his leaving the C.P.R. Mr. Spidy was presented with a silver tea set and a handsome travelling bag.

* * *

The Canadian firm of Torrington Company at Upper Bedford, Quebec, who for many years have been manufacturing knitting machine needles, have installed equipment for the making of all kinds of machine screws, cap and set screws, etc. Production will show rapid development from now and they are now in a position to supply the trade demands for these products. David J. Reid is the manager of the Canadian Company.

* * *

To further the construction of the new Labor Temple in the city of Montreal, the company, which was incorporated some time ago with a capital of $500,000, has appointed a permanent executive to carry out the necessary work. The various labor unions in the city are interested in the venture and it is not thought that any great difficulty will be experienced in the raising of the money. The new executive is as follows: President, Arthur Martel; vice-president. J. T. Foster; secretary, A. Bastien; directors, Gustave Francq, J. Lesperance, B. Drolet, J. L. Bourbonniere and S. Clegg.

NICKEL PLANT TO RESUME WORK

Sudbury.—The British-America Nickel Corporation will resume operations about April 20.

The new plans of the company are not for the complete operation of the plant as before it was closed down a couple of weeks ago.

Instead it is the intention of the company to leave the smelter closed for the present, but a good sized force of men will be put on to carry out a programme of underground development.

The fact that the company needed considerable underground work for the efficient working of the Murray Mine has been known for some time.

A second shaft has been necessary, as since the mine has been operating practically all the ore hauled to the surface went into the smelter direct, and there was little opportunity to pile up an ore dump on surface. A second shaft would overcome this. However, the blocking out and stopping of the ore bodies has been kept but little ahead of the actual mining operations, and it is understood that the work which will start towards the latter part of April will have the solution of this problem in hand.

The corporation has already selected all the men required for this work. They were not dropped from the payroll, but were really given a holiday.

These employees have been told to hold themselves in readiness for a call some time about the 19th of April.

The refinancing of the corporation has been completed and the Norwegian State Bank is lending their assistance to the corporation. Plans to resume work are timed to fit in with the receiving of the news that the loan has been confirmed.

The Norwegian Government has taken a material interest in this venture prior to putting its approval on the present investment of some two million dollars by the Norway bank.

During 1920 the number of large incandescent lamps sold in the U. S. totalled about 231,000,000. Of this amount about 215,000,000 were tungsten filament lamps and 16,000,000 carbon filament lamps. This means that 93 per cent. of the lamps sold had tungsten filaments. According to these estimates, the large lamp business of 1920 represents an increase of 25 per cent. over 1919.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$26 00
Lake Superior, charcoal, Chicago	40 50
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	28 96
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	39 25

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 50
Steel bars, base, Toronto	4 50
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 50
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate 3-16 and heavier	7 50
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	2 10-2 25
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 9 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$18 00	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	37 00	40 00
Spelter	7 75	7 50
Lead	6 50	7 50
Antimony	8 00	8 25
Aluminum	34 50	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$5 25	$5 25
Plates, ¼ up	4 75	4 75

PIPE—WROUGHT

Standard Buttweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
⅛	$ 6 50	$ 8 50	$.....	$.....
¼	5 31	7 41	5 91	8 01
⅜	5 31	7 41	5 91	8 01
½	7 10	8 63	7 95	9 48
¾	8 80	10 87	9 95	12 02
1	13 01	16 07	14 71	17 77
1¼	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	27 84
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	....	....
3	58 52	72 29	....	....
3½	74 06	90 62	....	....
4	87 75	107 37	....	....

Standard Lapweld Pipe

Per 100 Ft.

	Steel		Gen. Wrought Iron	
	Blk.	Galv.	Blk.	Galv.
2	$32 01	$ 38 67	$35 71	$42 37
2½	48 26	58 79	54 11	64 64
3	63 11	76 88	70 76	84 53
3½	75 90	92 46	85 10	101 66
4	89 93	107 55	100 83	120 45
4½	1 05	1 29	1 30	1 54
5	1 22	1 50	1 52	1 80
6	1 58	1 95	1 97	2 33
7	2 06	2 53	2 53	3 01
8L	2 16	2 66	2 66	3 16
8	2 49	3 07	3 07	3 64
9	2 98	3 67	3 67	4 36
10L	2 77	3 41	3 41	4 05
10	3 56	4 39	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 9 50	$ 9 00
Copper, crucible	11 50	11 00
Copper, heavy	11 00	11 00
Copper wire	11 00	11 00
No. 1 machine composition	10 00	9 75
New brass cuttings	7 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	6 00	6 00
Light brass	5 00	5 00
Medium brass	6 00	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 50	4 00
Tea lead	2 00	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$11 00	$12 00
Heavy melting steel	15 00	14 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	15 00	14 00
Malleable scrap	20 00	20 00
No. 1 machine cast iron	30 00	25 00
Pipe, wrought	8 50	8 00
Car wheel	30 00	25 00
Steel axles	20 00	18 00
Mach. shop turnings	8 00	6 00
Stove plate	23 00	20 00
Cast boring	5 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	47 00
Forging billets	48 50
Wire rods	57 00

NAILS AND SPIKES

Wire nails, base	$5 10
Cut nails, base	5 75
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

MISCELLANEOUS

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Gasoline, per gal., bulk	0 42
Chucking reamers	Net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 00	$ 6 50
Sheets, blue ann., No. 10	6 50	6 00
Canada plates, dull, 52 sheets	12 00	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz., galvanized	.....	.....
Queen's Head, 28 B.W.G.	11 50	.....
Fleur-de-Lis, 28 B.W.G.	10 50	.....
Gorbal's Best, No. 28	.....	.....
Colborne Crown, No. 28.	.....	.....
Premier, No. 28, U.S.	10 00	9 00
Premier, 10¾-oz.	10 50	9 40
Zinc sheets	13 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$
1¼ in.	27 25	
1½ in.	26 25	29 50
1¾ in.	29 75	27 00
2 in.	29 25	25 50
2¼ in.	33 00	28 50
2½ in.	44 75	31 50
3 in.	49 25	40 00
3¼ in.		48 50
3½ in.	63 50	43 50
4 in.	85 00	55 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21
Peerless	22
Grand	21½
Superior	21½
X L C R	16½
Atlas	19
X Empire	15
Ideal	18
X Press	13½

WASTE

Colored

Lion	13½
Standard	12
No. 1	14
Popular	10½
Keen	9

Wool Packing

Arrow	35
Axle	28
Anvil	22
Anchor	17

Washed Wipers

Select White	20
Mixed colored	10
Dark colored	09

This list subject to trade discount for quantity.

RUBBER BELTING

Standard	10%
Best grades	15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$30 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	32 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	38 00	42 00
Copper sheet, planished, 16 oz. base	44 00	48 00
Braziers', in sheets, 6 x 4 base	36 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

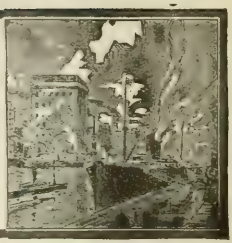
PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



Engineering

The Dundalk Woollen Mills will be rebuilt at an estimated cost of $25,000.

Louis Herschorn, 167 St. Paul Street East, is planning to alter warehouse.

The Neal Baking Co., Windsor, Ont., are planning a new bakery to cost $250,000.

Joseph Crane, of New Westminster, will construct a shipyard at North Vancouver, B.C.

H. B. Charade, 2770 Hutchison Street, Montreal, is contemplating the erection of an automobile repair shop.

A moving picture house will be erected at Moose Jaw, Sask., by the Famous Players Moving Picture Corporation.

A warehouse will be erected at Lethbridge by the Winnipeg Oil Company, Erin and Notre Dame Avenue, Winnipeg.

J. H. Stewart, architect, 344 Lister Street, Hamilton, Ont., will receive tenders for erection of garage estimated to cost $40,000.

An attempt is being made by the local board of trade to have the Port Arthur Structural Iron Works locate its plant at Sault Ste. Marie.

Owing to the partial collapse of one of the wing dams, the 1,500 horsepower electric plant at Parry Sound is almost a complete wreck.

The Fairweather Building, 297 Portage Avenue, Winnipeg, is to be remodelled into a restaurant to be operated by Julius Bros., 538 Main Street. The cost is estimated at $90,000.

A theatre will be erected by the Winnipeg Amusement Co. at the corner of Main and Church Streets, and the general contract has been placed with Sutherland Construction Co., 301 Merchants Bank Building.

The Normandy Sales Co., Ltd., has been incorporated with head offices at Toronto, and capital stock of $50,000, to carry on the business of making, buying and selling automobile tires, tubes and auto accessories of all kinds.

It was stated by Col. E. W. Steadman, A.R.C.S., at the annual popular lecture by the Engineering Institute of Canada in the Victoria Museum, Ottawa, that German-made mercantile airplanes are being made and laid down in Canada, while British manufacturers are being forced to close their factories owing to lack of support.

GERMANY IS REBUILDING HER FOREIGN TRADE VERY RAPIDLY

The foreign trade of Germany, to which the London conference gave much attention in its discussions and plans, apparently amounted, says a statement by the National City Bank of New York, to nearly or perhaps quite $2,000,000,000 in the calendar year 1920, as against about $5,000,000,000 in the year prior to the war, though the ratio of "total values" of 1920 compared with those of 1913 does not, of course, indicate a corresponding ratio in quantity, since prices of 1920 were much higher than those of 1913.

This estimate of approximately $2,000,000,000 as the total foreign trade of Germany with 60,000,000 population in 1920, as against $5,000,000,000 with 67,000,000 population prior to the war, is necessarily based upon the trade figures of the countries buying from or selling to her, since her own trade figures at the present time are not only fragmentary, but stated in units of a depreciated and constantly fluctuating currency.

The race between the United States, Great Britain and France to regain trade with Germany has been a close one. Official records of the three countries in question show that the trade of the United States with Germany in 1920 was $390,000,000, that of Great Britain £82,255,000 and that of France approximately 3,500,000,000 francs. Belgium and Italy also showed an equal trade willingness to "forget the past," while the neutrals on all of her frontages, Switzerland, Netherlands, the Scandinavian States, Czecho-Slovakia, Poland, and even Soviet Russia, showed marked gains over the preceding year, apparently bringing the grand total of Germany's foreign trade in 1920 to approximately $2,000,000,000.

Frank M. Foster, transportation engineer, Windsor and Detroit, has purchased 51 feet by 110 feet on the north side of Pitt Street, Windsor, Ont., where he is intending to build a large passenger car service station and motor show rooms.

The Dodge Brothers Motor Car Co., which has been closed since last December, reopened on March 17 with a force of between 3,500 and 4,000 men, it was officially announced at the company's offices. The company normally employs 20,000 men.

A very enjoyable evening was held at the King Edward Hotel, Toronto, by the firm of Barber, Wynne-Roberts & Seymour, consulting engineers, of Toronto, on the occasion of their first annual banquet on Friday night.

The Universal Tires, Ltd., has been incorporated with head office at Montreal, and capital stock of $50,000, to carry on the business of dealers in automobile tires and accessories and to manufacture, buy, sell, repair and deal in automobile tires, etc.

A warehouse will be erected shortly by an American plumbing and hardware supply company on York Street, London, Ont. The new building will be three stories in height and will cover approximately 4,000 square feet.

The Hart Stocker Co., Ltd., Edmonton, Alta., has been incorporated with capital stock of $2,000,000 to carry on the manufacture of farm implements, machinery, etc.

The Smiths Falls Malleable and Castings Co., Ltd., Smiths Falls, Ont., recently incorporated, have increased their capital stock from $150,000 to $750,000 and provision is made for the manufacture of steel castings. The company plan to double the capacity of their No. 2 plant and also equip a machine shop.

New Arrangement.—The General Combustion Co. of Canada have secured the Canadian representation for T. H. Watson & Co., of Sheffield, England, and will handle, build and sell their various electric smelting, melting and refining furnaces. The Canadian company will also handle the "Greaves-Etchells" type of furnace, largely used in United States and European countries. The General Combustion Co. are also taking over the designs of the Electric Furnace Construction Co., of Philadelphia, on the different types of electrically heated core ovens, annealing and heat-treating furnaces, and will have the active co-operation of the American company in the solution of furnace problems generally.

PURCHASING AGENTS START MOVE TO MAKE CONTRACTS BINDING

By HARRY BOTSFORD

"TWO months ago," a paper salesman told me the other day, "I had over $190,000.00 worth of orders on my books. Yesterday the president of the company called me in and told me that, due to cancellations, those same orders have dwindled to $10,000.00. Isn't that enough to discourage a fellow?"

The salesman was right—it is enough to discourage even the most stout hearted of individuals! As a matter of fact the above situation is too common to-day and it is one of the most disturbing factors that business has to contend with in this day of getting back to normal conditions. The contractual break-down is directly allied to the cancellation evil and while business men, as a rule, fume and fret over the deplorable situation, apparently little or nothing aside from a few strictly temporary emergency measures have been adopted or tried out with a view of eliminating the present evil.

The National Association of Purchasing Agents have long realized that a solution to the problem must be found and that such a solution must be arrived at by a calm getting-together of both sides affected by the issue and trying to reach some equitable, practical and inviolate form of contract which will not place any unfair burden on any of the parties concerned.

In their effort to make contracts safe the National Association of Purchasing Agents are co-operating with various trade, manufacturing and professional associations in the United States and Canada in an attempt to arrive at a co-operative contract form which will be possible to standardize. The N. A. P. A. intend to reach a contract form, which, when universally accepted and established, will result in a crystallization of business opinion toward living up to contractual obligations.

The working plan of the N. A. P. A. is simplicity itself. Each of the national commodity committees will work out a contract form meeting with their specific needs. This, in turn, will be presented to particular trade, manufacturing or professional organizations interested and suggestions and revisions requested on the form. If necessary joint conferences will meet and arrive at mutual agreements.

When the various commodity contracts are worked out they will be turned over to the standardization committee, who will then draw up a basic standard form of contract, which will meet the need of every industry, and, in conjunction with the commodity committees, make provisions for each special commodity requirement.

This briefly, is the definite program worked out by the National Association of Purchasing Agents. It is the organization's wish that every business firm and association will co-operate with them in this matter. It is not the purpose of the N.A.P.A. to inaugurate a contract form that will merely satisfy the buyer, but rather a contract form that is mutually fair in every phase to buyer and seller alike.

The N.A.P.A. have taken the initiative in the solution of this tremendously important problem and in the immense amount of work involved they must have the confidence and co-operation of the entire business and industrial world. Any suggestion as to the proposed form will be welcomed at the national headquarters of the National Association of Purchasing Agents at 19 Park Place, New York City.

Let us all help to make contracts safe.

WELDING SOCIETY ELECTS OFFICERS

Newly Formed Association Will Go Ahead and Do Educational Work in Canada

The recently formed Canadian Welding Society held a meeting this month in Montreal, when the following officers were elected: J. H. Wood, Canadian manager of the Commercial Acetylene Supply Co., of Toronto, was elected president; first vice-president, T. Jones, works manager of the Canadian Vickers, Ltd.; second vice-president, H. E. Musset, sales manager of the Canada Carbide Co.; both vice-presidents are Montreal men.

The six directors are F. Borys, of L'Air Liquide Society; R. H. Combs, of the Prest-O-Lite Co.; F. C. Hamilton, of the Canadian John Wood Co.; J. G. McCarty, of the Metal and Thermit Corporation; A. J. McDougall, of the National Electric Products Co., and W. F. Thatcher, of the Dominion Oxygen Co.

Scrap Metal Market

The scrap market continues to decline.

On the Chicago market it was thought the bottom had been reached, but practically all grades have gone considerably lower. Railroads continue to pour out large lists and as they need the cash realized from this material, they are letting it go at the low figures offered.

The scrap prices are so low at Boston, that small dealers say they cannot pay loading and cartage charges and net a profit even if the material were given them, particularly is this true of turnings and borings which are down to $5.50. Mixed borings and turnings in fact have sold as low as $4.50.

Considerable weakness is shown in scrap prices on the New York market, and only a few if any grades have not dropped off during the past few days. City wrought is scarce and firm, but the other grades have declined from $1 to $2. A factor in the present decline is the low prices dealers can do in buying from the railroads.

Practically no market exists at Pittsburgh, as where ordinarily 1,000 tons would represent a minimum sale, sales at present involve single carloads. Heavy melting steel is down from $15 to $16, to $13 to $14, and bundled sheets from $11 to $12, to $10 to $11.

The scrap market at Buffalo is quiet with little inquiry. The principal interest is trading between dealers in a few cars of stove plate and No. 1 cast scrap. The stove plate is bringing $18.50 to $19, the cast about $20. One steelmaker is still paying $13.50 for heavy melting steel, and picking up a few lots at this price.

Pig Iron Market

The downward trend which has characterized the pig iron market for many weeks continues.

On the Pittsburgh market only two sales of importance were made during the week. A merchant producer with furnaces in the Valley reports a sale of 1,500 tons of standard basic for immediate delivery to a Pittsburgh consumer at $25 furnace. One company closed for 500 tons of basic at $22.75, valley furnace, but this iron was purchased from a middleman, and it is thought will come from some of the large stocks lying in the yards of steel manufacturers in the Mahoning Valley. There is very little interest shown in Bessemer, and very few inquiries in foundry iron.

Chicago reports that a melter in Wisconsin who recently bought 2,000 tons of Northern foundry at $26 delivered has purchased a like amount at the same price. A sale was made of 200 tons of Southern foundry at $24 base Birmingham. Generally speaking, the market is quiet and prices continue to slide downward.

On the New York market a sale was made of 500 tons of No. 2 plain pig iron for prompt delivery at $24.46 eastern Pennsylvania furnace. This is the lowest price which has been recorded. The seller will not sell any more at that price and is now asking $26 furnace. There is a little improvement in inquiry, and one firm is figuring on several thousand tons for prompt shipment.

The market shows very little change at Cleveland. One interest reports sales in prompt shipment foundry iron during the week aggregating 2,000 tons and including one 500 ton lot for shipment to New England. This business was taken at $26. This is the usual quotation on foundry iron in the Valley district, but $27 is being quoted by most of the local furnaces.

The Buffalo market shows no improvement from the low ebb reached last week, nor is there much change in sight in the immediate future. Sales are light, a total movement of 2,000 tons for the week is reported by one furnace. Inquiry is poor. Little is heard of resale, and this is a hopeful sign to furnace interests which see a possibility that buyers of resale iron will be obliged to deal with furnaces rather than brokers.

Philadelphia reports that the sales of the week have been confined to foundry iron, a total of a few thousand tons, including one lot of 1,000 tons and another of 600 tons. Prices on this business have ranged from $25 to $26 furnace for iron analyzing 1.75 to 2.25 silicon.

Personal

Senator Smeaton White, of Montreal, was elected to the board of the Steel Company of Canada at a meeting of the directors. The election of Senator White was to fill the vacancy created by the death of Francis H. Whitton, of Hamilton.

The death occurred on March 16 of Kenneth A. MacKenzie, of the Technical School staff, Toronto. Mr. MacKenzie has been with the Technical School since 1917. Previous to that he was a teacher in the public schools of Weston and Bolton, being later engaged in engineering work in British Columbia and other parts of the West.

J. C. Blair, Canadian representative of the Alfred Herbert Co., has returned to Toronto after an extended trip through the eastern territory, including Montreal through to Halifax, and also including steel and coal areas of Nova Scotia and Cape Breton. Mr. Blair was particularly impressed with the reception accorded the presentation of his case for British-made goods, this being the first time he has had the opportunity of going over the ground personally since coming to Canada.

NEW CATALOGUES

Those interested in any of the catalogues described below can procure a copy of the same by writing direct to these firms. Mention that you noticed this in Canadian Machinery.

ROLLER BEARING BOOKLET

The American Roller Bearing Co., Pittsburgh, Pa., have issued a new bulletin No. 1005, dealing with their type C roller bearings. These are the heavy duty and standard types, and first of all the characteristics of these bearings are gone into. The proper installation of the same is next discussed, after which several applications are shown in photographic and line drawing form. The specifications covering these bearings completes this interesting booklet, and to those interested in roller bearings, we feel sure it would prove of interest.

TOOL HOLDER CATALOGUE

The Canadian Production Tool Co., Ltd., Walkerville, Ont., have issued a very interesting catalogue dealing with their new line of tool steel tool holders. These tool holders are said to be able to use up scrap high speed steel of all sizes within their range, and even worn out drills are used as turning tools with success.

Various sizes and styles are made, these being shown in detail. Special tool holders are also illustrated, and in fact the 32 pages of this book is full of information to the man wishing to economize on his steel.

HELPS AND HINTS

The British Aluminium Co., Ltd., with Canadian offices at 263-267 Adelaide St., Toronto, Canada, have issued four very useful booklets on aluminum. Booklet No. 1 contains hints and helps for foundry users of this metal, while booklet No. 2 is devoted to aluminum spinning and press work.

The third booklet covers this metal as used in machine shop practice, and the fourth volume speaks on the finishing processes sometimes put on this metal. These include cleaning, polishing, painting, coloring, etc. These booklets have been bound in fairly stiff covers and are made to fit the pocket, so that they should prove a ready reference to those interested.

COTTRELL PROCESS

The Western Precipitation Co., 1016 West 9th St., Los Angeles, Cal., have issued a catalogue dealing with their Cottrell processes of electrical precipitation of suspended particles from gases. First of all the history of electrical precipitation is given, after which the operation of the Cottrell precipitator is explained.

Next the construction of the same is discussed, after which a number of applications are shown in photographic form. Particulars of these installations are given, and to those interested in this process we can recommend a reading of the booklet which consists of some 32 pages.

INTERESTING DATA

F. H. Emra and partners, civil engineers, Central Chambers, Ottawa, have taken over the Canadian rights for various English machines, some of which have been forwarded for our attention. These take the form of two catalogues, the first of these being entitled "Mechanical Power Transmission."

This book deals with the Power Plant Co., Ltd., products of West Drayton, Middlesex, England, and is divided into several sections, the first of which is devoted to a talk about themselves and their facilities. Section two deals with double helical and other gears, and explains their unique method of manufacture.

The third section deals with photographic reproductions of interesting installations. Section four describes briefly the Sykes gear cutting machine, while section five discusses the use of their flexible couplings. Section six, which is the last, deals with the Mitchell type of thrust block, and states its employment in marine propulsion.

The second book deals exclusively, and more fully with the Sykes patent gear generating machine, and discusses how it was evolved, improved upon, and how one operator can now attend to three machines.

MACHINE TOOL CATALOGUE

The St. Louis Machine Tool Co., St. Louis, Mo., have issued a catalogue, No. 16, which deals with their line of machine tools. This includes grinders of various types, polishing machines, tapping machines, tapping chucks, and safety collars and guards. Details are given regarding the various parts going to make up these machines, and some interesting data regarding grinders is given on the last page of this book.

DIAMOND STATE FIBRE

A handsome, substantially-bound new catalog, profusely illustrated and containing a summary of Diamond Fibre and its different uses, has just been issued by the Diamond State Fibre Company of Canada, Limited. This catalog should prove of interest to manufacturers, engineers and others who wish to keep abreast of improvements in raw material and the finished product.

STATIC ELECTRICITY.

Here is a peculiar case, where trouble arose from static electricity in a textile factory. The machine affected was a 15 horse-power motor fixed to a platform suspended from a wooden ceiling. The frame of the motor was not earthed, the only electrical connection being that of the leads. It was observed that flashing between the stator and rotor took place at intervals of from four to ten minutes, and on dry days was very pronounced. The motor was tested for ordinary faults, but nothing was found out of order. Finally, the flashing affected the stator insulation, and the motor was burned out. A spare motor was put into use immediately, but still there was the same amount of flashing. Then at last the frame of the machine was earthed, and the trouble ceased. Steps were next taken to devise a means of collecting and disposing of the static charge from the belt, when the trouble was completely overcome.

The American Society of Testing Materials have adopted as standard a test for determining the softening point of fire-clay brick, by comparison of test cones with standard Orton pyrometric cones heated in a suitable furnace.

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1 Centrifugal Pump, 2½ in. x 1½ in. Gould.
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AMERICAN FIRM, SPECIALIZING IN OXY-acetylene welding and cutting equipment, is desirous of securing representatives and agents in Canada. Apply Box 763F, Canadian Machinery.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

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WANTED—NEW AND RE-MANUFACTURED gas and gasoline engines, boilers, saw-mill machinery, planing mill and sash and door factory machinery. New and manufactured iron and wood-working machinery. Electric motors, dynamos, direct connected steam operated generators, portable electric tools. Builders' hoists, elevators. Box 739F, Canadian Machinery.

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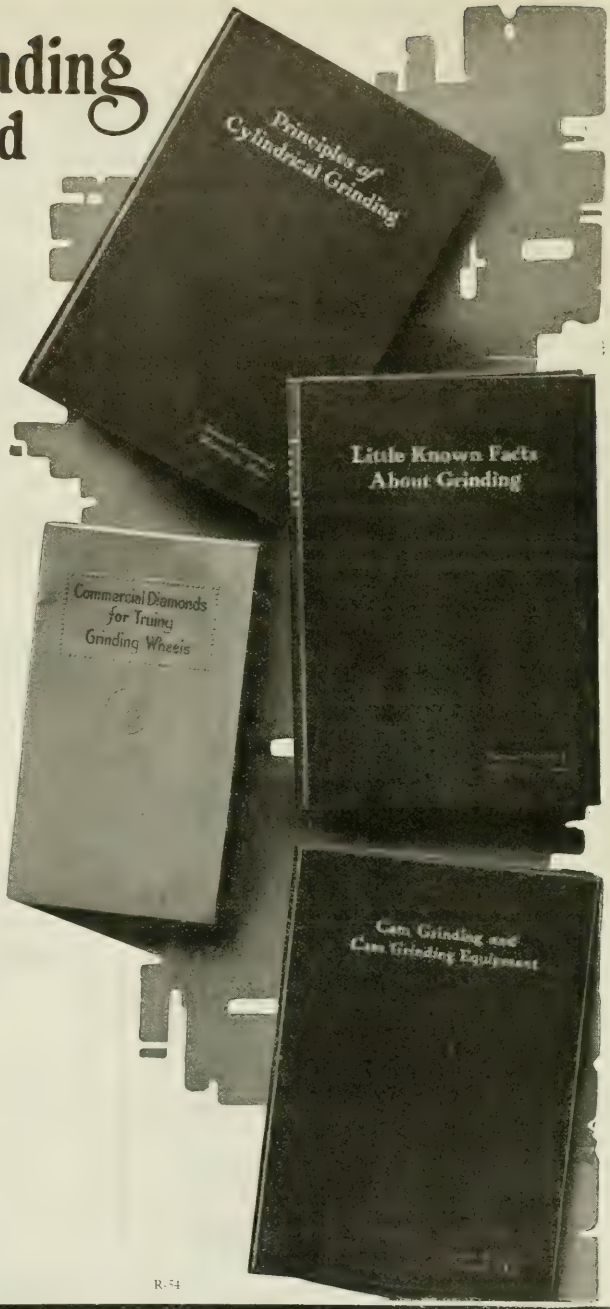

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If interested tear out this page and place with letters to be answered.

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Canadian Machinery BUYERS DIRECTORY

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Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Ltd., Montreal, Q
Federal Eng'r'ng Co., Ltd., Toronto, Ont
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., T. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Union Carbide Co. of Can., Ltd., Welland, Ont.

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Electric Steel & Engineering Co., Welland, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Copper
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel
Davison Mfg. Co., Thos., Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.

Castings, Steel
Dom. Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis
Jones & Lamson Machine Co., Springfield, Vermont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport Conn
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montreal, Que.
Seymour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. H., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada Ltd Montreal, Canada
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd Toronto, Ont.
Kimber & Hilliler Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hilliler, St. Catharines, Ont

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill

Dividing Heads
Ackworthle, Ltd., John, Birmingham, Eng
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Alkenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Alkenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co. Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streetsinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland, O
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd. Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Alkenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing
British Smelting & Refining Co., Ltd. Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S
Steel Co. of Canada, Ltd., Hamilton, Ont

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que
Ford-Smith Machine Co., Hamilton, Ont
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont
Sturtevant Co., B. F., Boston, Mass

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor, Ont.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Chesterman & Co., Ltd., J., Sheffield, Eng
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.

BUYERS' DIRECTORY

Gages, Snap, Thread and Cylindrical
Ackworthle, Ltd., John, Birmingham, Eng
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co of Can., Lt Montreal, Que
Atkins & Co., Inc., E. C., Indianapolis, Johansson Inc., C. E., Windsor, Ont

Gages, Thread
Ackworthle, Ltd., John, Birmingham, Eng
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Garnet, Emery and Flint Paper and Cloth
Ritchey Supply Co., Toronto, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Diamond State Fibre Co of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co of Can Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal Que
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Dom. Foundries & Steel, Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont
Hull Iron & Steel Foundries, Hull, Que

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R I
Canadian SKF Co., Toronto, Ont
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glasco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada Ltd Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged
Canada Foundries & Forgings Co Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto Ont.
Philadelphia Gear Works Philadelphia, Pa.

Gears, Machine Moulded
Can Steel Foundries Montreal, Que

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont

Generators, Electric
Holden Co., Ltd., Montreal, Que
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal

Grinding Machines, Abrasive Belt
Beaver Engineering Co., Tipton, England
Norton Co of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng
Streiberger Co. of Can., Ltd., Chas A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines Chaser
Lees & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada Ltd Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Machine Co., Greenfield, Mass
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield Vermont.
Matchless Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England
Blount Co., J. G., Everett Mass.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co of Canada Ltd., Brantford, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Ackworthle, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co. Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont
Brown, Boggs & Co., Ltd., Hamilton, Ont
Holden Co., Ltd., Montreal, Que

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co. Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot

Hydrogen
National Electric Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal, Q.

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Master Motor Co. Ltd., Orillia, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Mach. Co., Grand Rapids, Mich
Simonds Canada Saw Co., Montreal, Que

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield Vermont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal
Sidney Machine Tool Co., Sidney, Ohio
Steinle Turret Machine Co., Madison, Wis
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton Ont

Linoleum Mill Machinery
Bertram, Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F. & Co., Ltd., Toronto, Can

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal Q
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I
Cleveland Twist Drill Co., Cleveland, O
Pratt & Whitney Co., of Canada Ltd Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Metals, Alloy
British Smelting & Refining Co., Ltd Montreal, Que.
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Tallman Brass & Metal, Ltd., Hamilton, Ontario.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metalite Cloth
Ritchey Supply Co., Toronto, Ont.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Thread
Pratt & Whitney Co., of Canada Ltd Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith, Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Rockford Machine & Tool Co., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sheljer & Hartley, Inc., Worcester, Mass.

Nails and Staples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.

Oil Filtering and Storage Systems
Bowser, S. F. & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F. & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont.
Cataract Refining Co., Toronto, Ont
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cataract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que
Graton & Knight Mfg. Co., Worcester, Mass
Guildford & Sons, L. . Halifax, N.S

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Waggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co., Ltd. Montreal, Que.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Alkenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthle, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthle, Ltd., John, Birmingham, Eng
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Terry & Co., John C., Birmingham, Eng

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Alkenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
MacKinnon Steel Co., Sherbrooke, Que

Pumps, Automobile Tire
Tainman Brass & Metal, Ltd., Hamilton, Ont.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Electric Steel & Engineering Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot
Trahern Pump Co., Rockford, Ill.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Victor Tool Co., Waynesboro, Pa.

Reamers, Expanding
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
McCroskey Tool Corp., Meadville, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Rheostats
Northern Electric Co., Montreal, Que

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Respirators
Willson Goggles, Inc., Reading, Pa.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven Mich.

Saw Frames and Blades, Hack
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Inc., Hamilton, Ont.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthle, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal Q

Screens
Can. Wire & Iron Goods Co., Hamilton Ont.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati, Ohio
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Second-Hand Machinery
(See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stuart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Hoyt Metal Co., Toronto, Canada.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Spectacles, Industrial
Willson Goggles, Inc., Reading, Pa.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Tanks
Can. John Wood Mfg. Co., Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthe, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthe, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
International Machinery & Supply Co., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont

Thermometers
Bristol Co., Waterbury, Conn

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield Vermont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Burgess & Marchand, Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.
National Machine Tool Co., Racine, Wis
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Streiinger Co. of Can., Ltd., Chas. A. Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electric Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Bernard Industrial Co., A., Fortierville Que.
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que

BUYERS' DIRECTORY

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Can. Atlas Crucible Steel Co., Toronto Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Maple Leaf Mfg. Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Maple Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Tubing, Welded
International Nickel Co. of Can., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Tubing, Welded Steel
Tube Co. of Canada, Toronto, Ont.

Turbines, Water
Kennedy & Sons, Wm., Owen Sound, Ont.

Turret Heads
Ackworthle, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal Q
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Metal Workers'
Aikenhead Hardware, Ltd., Toronto, Ont.
Columbia Hdwe. Division, Cleveland, O

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R I
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn
Hoosier Drilling Mach. Co., Goshen, Ind.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque, Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont

Washers
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Tallman Brass & Metal, Ltd., Hamilton, Ont.

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Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
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Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

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Can. Wire & Iron Goods Co., Hamilton, Ont.

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Baird Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
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Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
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Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

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reenfield Tap & Die Corp., Galt, Ont.

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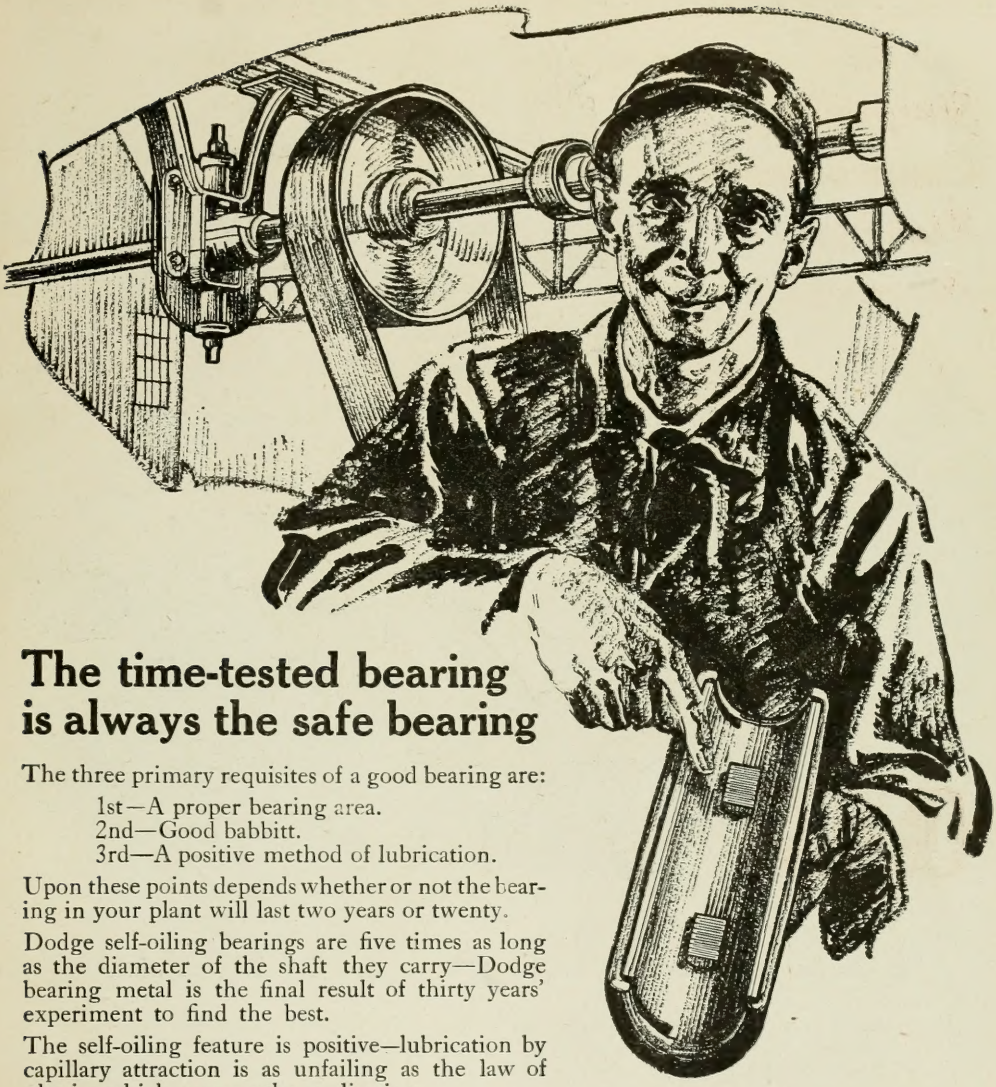

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